Petition

81-689

Office-Supreme Court, U.S.
FILED
OCT 9 1981
ALEXANDER L. STEVAS,
CLERK

No. ____

IN THE

Supreme Court of the United States

OCTOBER TERM, 1981

GREFCO, INC., *Petitioner*

v.

KEWANEE INDUSTRIES, INC., *Respondent*

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

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QUESTION PRESENTED FOR REVIEW

Whether "materiality" to establish patent fraud requires a mere showing that omissions or misstatements "might have" influenced the patent examiner, as held by the Third Circuit, or whether it requires a stronger showing as held by other circuits in patent fraud cases and by this Court in its rejection of a "might have" materiality approach in securities fraud cases.

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PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

OPINION BELOW

The decision of the Court of Appeals, not yet reported, is a judgment order entered on August 3, 1981, affirming without comment the decision of the U.S. District Court for the District of Delaware. The order issued by the Third Circuit appears in the Appendix to this Petition [A-1].[1] The trial court opinion is reported at 499 F.Supp. 844 (D. Del. 1980) and the printed slip opinion is included in the Appendix [A-3].

JURISDICTION

Jurisdiction of the trial court was based on 28 U.S.C. §1338(a). The jurisdiction of the appellate court was based on 28 U.S.C. §1292(a)(1). The judgment of the Court of Appeals for the Third Circuit was entered on August 3, 1981. A timely petition for rehearing *en banc* was denied on September 3, 1981. The Court of Appeals issued an order dated September 14, 1981, staying the

[1] Citations to the Appendix will be to the Appendix page number and cited as [A-].

mandate until October 10, 1981, pending the filing of this petition. Jurisdiction of this court is invoked under 28 U.S.C. §1254(1).

STATUTES AND RULES INVOLVED

United States Constitution, Article I, Section 8, Clause 8:

> [The Congress shall have Power]
>
> To promote the Progress of Science and useful arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries . . . .

STATEMENT OF THE CASE

This case arises out of a suit for infringement of a patent owned by Petitioner Grefco[2] on a layered composite of plastic foam and perlite board widely used commercially as a thermal insulation product. Defendant Kewanee admitted at trial that an insulation product sold by its Apache Foam Products division, known as Millox, infringes the Grefco patent. Kewanee also admitted that the patented product is "premier" in the industry and is superior to all other composite insulation products Kewanee tested. The lower court found the product to have become a commercial success when the energy crisis demanded improved insulation materials.

The trial court, however, held the Grefco patent invalid in view of two prior publications, including the "JCP" article [A-69], and invalid and unenforceable as fraudulently obtained. Applying the Third Circuit "might have" standard of materiality, which requires only that

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[2] Grefco, Inc. is a wholly owned subsidiary of General Refractories Company. The patent is No. 3,510,391 [A-55] to Bolster et al., issued May 5, 1970, on an application filed May 15, 1967.

an omission or misstatement "may have had an effect on the examiner," see Section B, *infra*, the trial court concluded that Grefco's failure to disclose to the patent examiner (1) portions of the JCP article and (2) the results of two particular tests was fraudulent. The trial court awarded Kewanee attorney fees because of Grefco's "fraudulent conduct in the procurement of the patent" [A-52-3].

Grefco seeks review of the fraud decision, particularly the standard applied by the courts below in assessing materiality, and reversal of the holding of fraud and award of attorney fees or remand to the courts below for adjudication of the fraud and attorney fees issues under the proper materiality standard.

In preparing the patent application, Grefco's attorney reviewed prior art references relating to combinations of various materials with plastic foam. In the application, he summarized relevant portions of these prior art references. Finding that the summary did not include all statements in the JCP article which the patent examiner "*might*" have considered relevant [A-49-50], the trial court held that the failure to disclose the full text of the JCP article or cite it amounted to fraud on the Patent and Trademark Office ("Patent Office").

Relying on the testimony of F. Coglianese, an author of the JCP article, the trial court concluded that the Grefco patent was invalid in view of the article and that Grefco committed fraud in failing to adequately disclose it. The court cited Coglianese's testimony in holding:

> . . . although the use of perlite board is not expressly disclosed by the [JCP] article, "to someone with knowledge, to me" the reference to "fiber board or other barrier" would teach that perlite board and urethane foam could be combined in a steel deck roof assembly [A-19].

Coglianese, now president of Apache, the division of Kewanee which has infringed Grefco's patent, was an inventor on a 1969 Apache patent application directed to the same invention, filed after the publication of the JCP article.[3] In contrast to the significance Coglianese attached to the JCP article in his testimony, neither he nor Apache disclosed the JCP article to the Patent Office during the prosecution of the Apache patent application. However, the courts below did not give weight to these facts in adjudicating the issue of fraud.

The trial court also found fraud in Grefco's failure to disclose two tests conducted in April 1967 and August 1967 in which composite boards combining urethane (plastic) foam and 3/4" perlite board failed the "UL tunnel test." The trial court held the 1967 tests material because they related to properties of the product, even though passing the UL tunnel test was not the basis for patentability. The court felt that the patent examiner *"might"* have concluded from these tests that the product was not superior to other products [A-49-50].

Based on other information, the inventors believed the product would pass the UL tunnel test. In fact they were correct; it *does* pass the test. This identical product became a commercial success and is the very same product sold by both Kewanee and Grefco. The court, however, refused to accord any weight to the inventors' belief, holding that any doubts as to validity of the failed tests "should have been disclosed to the examiner for *his* determination" [A-48, emphasis the court's].

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[3] Apache was unaware of Grefco's patent application when it filed a patent application on the same product. Apache's attorney argued to the Patent Office that the composite product was patentable, but Apache's application was rejected because Grefco had made and patented the invention first.

The trial court thus held that Grefco committed fraud in failing to disclose two tests that incorrectly suggested a deficiency in a commercial product which possesses all the approvals and ratings required by testing organizations and has been admitted by Kewanee to be superior to every other composite insulation product of its type. Under the standard of materiality used by the trial court and the Court of Appeals, the inventors were not permitted to rely on their expert (and correct) appraisal of the tests.

This case brings to the Court the question of the propriety of the "might have" standard of materiality under which the findings of fraud were made. A serious conflict among the courts of appeals on this important issue of patent law can be resolved fully in this case.

REASONS WHY THE WRIT SHOULD BE GRANTED

A. The Proper Test of Materiality for Patent Fraud is an Important Question of Federal Patent Law Which Should Be Settled by This Court

For the patent system to achieve the Constitutional objective of promoting the progress of science and the useful arts,[4] it is essential that there be a uniform and workable definition of "materiality." The "materiality" standard is the benchmark for assessing the significance of any omission or misstatement in disclosures to the Patent Office by inventors or their attorneys. Over 100,000 patent applications are filed each year, and the standard of materiality is pertinent to each application.

A judicial determination that "material" information was withheld from or inaccurately presented to the Patent Office and that fraud was committed has grave consequences for the patentee: (a) his patent is invalidated; (b)

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[4] U.S. Const., Art. I, § 8, cl. 8.

he is subject to an award of attorney fees to an alleged or even an admitted infringer; and (c) he is subject to a treble damage counterclaim under the federal antitrust laws.

In *Walker Process Equipment, Inc.* v. *Food Machinery & Chemical Corp.*, 382 U.S. 172, 176-77 (1965), the Court held that intentional fraud in procuring a patent can result in antitrust treble damage liability. Since *Walker Process*, patent infringers have routinely interposed the defense of "fraud on the Patent Office" in infringement actions and counterclaimed under the antitrust laws.[5]

Unfortunately, the standard for determining whether an omission or misstatement was "material" has been viewed differently by different courts at different times. Presently, there is confusion and conflict among the circuits. As expressly recognized in a recent Tenth Circuit case, at least three different materiality standards now are being applied by the courts of appeals. *Plastic Container Corp.* v. *Continental Plastics of Oklahoma, Inc.*, 607 F.2d 885, 899 (10th Cir. 1979), *cert. denied*, 444 U.S. 1018 (1980).

In *TSC Industries, Inc.* v. *Northway, Inc.*, 426 U.S. 438 (1976), this Court granted certiorari in recognition of the need for a uniform and workable standard of materiality in assessing securities fraud charges. That same need exists today in the area of patent fraud. If the patent system is to provide meaningful incentives to inventors, the issue of patent fraud cannot depend on the particular circuit in which the patent is enforced, or be shrouded in uncertainty.

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[5] *See, e.g.*, Gholz, *Introduction, Attorney Liability in Patent and Trademark Cases*, 3 Am.Pat.L.A.Q.J. 175 (1975); Note, *Patent Attorney Liability for Fraud on the Patent and Trademark Office: A Need for Effective Standards*, 1978 Utah L.Rev. 297, 299.

B. The Courts of Appeals are in Conflict as to the Standard of Materiality in Patent Fraud Cases

There is a major split among the courts of appeals with respect to the standard of materiality in patent fraud cases. The Third Circuit has adopted a "might have" or "but it might have been" test whereby omissions or misstatements are considered material if "the patent *might* not have issued had full disclosure been made."[6] Under this test "courts look to whether the misrepresentations made in the course of the patent prosecution *may have had an effect* on the examiner," *In re Multidistrict Litigation Involving Frost Patent*, 398 F.Supp. 1353, 1368 (D. Del. 1975), *modified*, 540 F.2d 601 (3d Cir. 1976) (emphasis added), or "might have influenced" the examiner, *Hercules, Inc.* v. *Exxon Corp.*, 497 F.Supp. 661, 689 (D. Del. 1980).[7] The Second Circuit also has set forth a "might have" materiality test for determining patent enforceability.[8]

The Tenth Circuit in *Plastic Container Corp.* v. *Continental Plastics of Oklahoma, Inc.*, 607 F.2d 885, 900 (10th

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[6] Trio Process Corp. v. L. Goldstein's Sons, Inc., 461 F.2d 66, 73 (3d Cir.), *cert. denied*, 409 U.S. 997 (1972) (emphasis added).

[7] The trial court below relied on the test for materiality set forth in In re Multidistrict Litigation Involving Frost Patent, 540 F.2d 601, 604, n.9 (3d Cir. 1976), where the Third Circuit adopted the following definition of "might have" materiality:

> Further, Trio Process, which followed Monsanto, viewed Monsanto as speaking to the situation in which "the patent *might* not have issued had full disclosure been made." Hence, in this Circuit, a misrepresentation which makes it "impossible for the Patent Office fairly to assess [the] application against the prevailing statutory criteria," will, given the requisite intent, lead to a finding of invalidity. [Citations and footnote omitted, emphasis in original.]

[8] *See* Timely Products Corp. v. Arron, 523 F.2d 288, 297-98 (2d Cir. 1975); Carter-Wallace, Inc. v. Davis-Edwards Pharmacal Corp., 443 F.2d 867, 881, 883 (2d Cir. 1971); SCM Corp. v. Radio Corp. of America, 318 F.Supp. 433, 449-50 (S.D.N.Y. 1970).

Cir. 1979), *cert. denied*, 444 U.S. 1018 (1980), expressly rejected the Third Circuit's "might have" test as "too speculative." Rather, the court held that "the more practical test is whether the examiner would have rejected the claims had he known all of the facts." *Id.* This test, known as the subjective "but for" test, also has been adopted by the Sixth Circuit [9] and the United States Court of Customs and Patent Appeals. [10]

A third test referred to in *Plastic Container*, the objective "but for" test, has been applied by the Ninth Circuit. [11] Under this test, the court determines whether "but for" the omission or misstatement the patent would not have properly issued.

The Fifth and Seventh Circuits have applied both the subjective and objective "but for" tests. [12]

The First Circuit recently added a possible fourth test to the potpourri of materiality standards in *Digital Equip-*

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[9] *See* Schnadig Corp. v. Gaines Manufacturing Co., 494 F.2d 383, 392-93 (6th Cir. 1974); Charles Pfizer & Co. v. FTC, 401 F.2d 574, 585-86 (6th Cir. 1968), *cert. denied*, 394 U.S. 920 (1969); American Cyanamid Co. v. FTC, 363 F.2d 757, 778-79 (6th Cir. 1966).

[10] *See* Norton v. Curtiss, 57 C.C.P.A. 1384, 433 F.2d 779, 795 (1970).

[11] *See* Union Carbide Corp. v. Filtrol Corp., 170 U.S.P.Q. 482, 521 (C.D. Cal. 1971), *aff'd per curiam*, 179 U.S.P.Q. 209 (9th Cir. 1973). *Cf.* Duff-Norton Co. v. Ratcliff, 362 F.2d 551, 553 (9th Cir. 1966).

[12] *See* Feed Service Corp. v. Kent Feeds, Inc., 528 F.2d 756, 762-63 (7th Cir.), *cert. denied*, 429 U.S. 870 (1976); CTS Corp. v. Piher International Corp., 527 F.2d 95, 99-100 (7th Cir. 1975), *cert. denied*, 424 U.S. 978 (1976); Parker v. Motorola, Inc., 524 F.2d 518, 535 (5th Cir. 1975), *reh. denied*, 526 F.2d 1407 (5th Cir.), *cert. denied*, 425 U.S. 975, *reh. denied*, 427 U.S. 908 (1976); Edward Valves, Inc. v. Cameron Iron Works, Inc., 286 F.2d 933, 947 (5th Cir.), *modified and reh. denied*, 289 F.2d 355 (5th Cir.), *cert. denied*, 368 U.S. 833 (1961); Swift Chemical Co. v. Usamex Fertilizers, Inc., 197 U.S.P.Q. 10, 28-9 (E.D. La. 1977); Rohm & Haas Co. v. Owens-Corning Fiberglas Corp., 196 U.S.P.Q. 726, 743 (N.D. Ala. 1977).

ment Corp. v. *Diamond*, 653 F.2d 701, 716 (1st Cir. 1981). That court, in vacating a Patent Office determination of fraud, criticized the Patent Office for not applying a "but for" standard, or a similarly rigorous test which would require that any omission or misstatement at least have a "likely effect" on the granting of all or part of the patent.[13]

The situation today in the courts of appeals with respect to the proper standard of materiality, especially the specific conflict between the "but for" and "might have" tests, is strikingly similar to that which existed in the area of federal securities law when this Court granted certiorari and rendered its opinion in *TSC Industries, Inc.* v. *Northway, Inc.*, 426 U.S. 438 (1976).

In *TSC Industries* the Court was asked to define "materiality" in the context of the S.E.C. proxy rules proscribing the omission or misrepresentation of "material" facts. The Seventh Circuit had defined materiality as including "all facts which a reasonable shareholder *might* consider important," *Id.* at 445 (emphasis in original), a

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[13] *Id.* at 715-16. The First Circuit in *Digital Equipment* commented that the present version of Rule 56 of the Patent Office Rules of Practice, 37 C.F.R. §1.56 (1980), seems to have adopted a definition of materiality more expansive than that applied in the fraud cases such as Norton v. Curtiss, 57 C.C.P.A. 1384, 433 F.2d 779 (1970). Rule 56 provides that:

> [I]nformation is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent.

The Patent Office, faced with the myriad of tests expressed by the courts, stated that it based the Rule 56 standard on TSC Industries, Inc., v. Northway, Inc., 426 U.S. 438 (1976). *See* Manual of Patent Examining Procedure ("M.P.E.P.") § 2001.05 [A-93]. However, *Digital Equipment* makes it evident that Rule 56 has not been *applied* by the Patent Office in a manner which captures the spirit of any decision of this Court bearing on the subject of fraud. See Section C, *infra*.

test virtually the same as the "might have" test of patent fraud materiality applied by the Third Circuit. Other circuits regarded the "might consider important" test as setting too low a threshold for materiality, just as the "might have" patent fraud test is considered inappropriate by many of the circuits. The Court granted certiorari in *TSC Industries* to resolve that conflict, *id.* at 443, and should do so here. A uniform and workable definition of materiality is no less important in the field of patent law. The patent system is vital to United States business and to society in general, a fact underscored by the Constitutional basis for the patent system and recent decisions of this Court.[14]

The conflict among the circuits also affects the operation of the Patent Office. Today, the Patent Office must act in compliance with the First Circuit decision in *Digital Equipment.* Tomorrow, a Patent Office review case may emerge from a circuit announcing a totally different standard of materiality.[15] Uniformity, which can be

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[14] Dawson Chemical Co. v. Rohm & Haas Co., 448 U.S. 176, *reh. denied,* 448 U.S. 917 (1980); Diamond v. Chakrabarty, 447 U.S. 303 (1980).

[15] The confusion generated by judicial decisions based upon incompatible standards of materiality has caused the Patent Office to recently restate its fraud guidelines in a conflicting and confusing manner. Inventors and attorneys are advised, for example, that:

> 10. When in doubt, submit prior art information. Even though the attorney, agent, or applicant doesn't consider it necessarily material, someone else may see it differently and embarassing questions can be avoided.

But the Manual then admonishes:

> 13. Don't submit long lists of prior art if it can be avoided. Eliminate clearly irrelevant and marginally pertinent cumulative prior art . . . .

M.P.E.P. § 2004 (Rev. 5, Jan. 1981; distributed in September 1981) [A-97].

achieved by an authoritative decision by this Court, is badly needed.

C. The "Might Have" Test Used by the Third Circuit Conflicts With Decisions of This Court

In *Walker Process Equipment, Inc.* v. *Food Machinery & Chemical Corp.*, 382 U.S. 172, 177 (1965), the Court set forth a "but for" materiality test: "but for" the omission or misstatement the patent would not have issued. Similarly, long before *Walker Process*, the Court, in *Corona Cord Tire Co.* v. *Dovan Chemical Corp.*, 276 U.S. 358, 374 (1928), applied a "but for" standard in holding that the "reckless" inclusion of certain false statements in affidavits submitted to the Patent Office was not fraudulent because the misrepresented facts were "not indispensable to the granting of the patent." Opinions of this Court subsequent to *Corona Cord* recognizing the duty of candor on those dealing with the Patent Office did not address or modify the materiality standard defined in *Corona Cord.*[16] As observed in *Rohm & Haas Co.* v. *Owens-Corning Fiberglas Corp.*, 196 U.S.P.Q. 726, 743 (N.D. Ala. 1977), "[t]he Supreme Court has never held a patent invalid or unenforceable for less than an intentional misrepresentation to the Examiner, *but for* which the patent application would not have been allowed." [Emphasis added.]

The Third Circuit's "might have" test departs radically from this Court's "but for" standard. It improperly

[16] *See* Kingsland v. Dorsey, 338 U.S. 318 (1948), *reh. denied*, 338 U.S. 939 (1950); Precision Instrument Manufacturing Co. v. Automotive Maintenance Machinery Co., 324 U.S. 806, *reh. denied*, 325 U.S. 893 (1945); Hazel-Atlas Glass Co. v. Hartford-Empire Co., 322 U.S. 238, *reh. denied*, 322 U.S. 772 (1944), *overruled on other grounds*, Standard Oil Co. v. United States, 429 U.S. 17 (1976); Keystone Driller Co. v. General Excavator Co., 290 U.S. 240 (1933).

shifts the inquiry from the relationship between the omitted or misstated information and the grant of the patent — the decisive consideration applied by this Court in *Corona Cord*, to the relationship between the omissions or misstatements and the many possible facts which might be of relevance to the examiner during his process of evaluating patentability. This erosion of the "but for" requirement subjects the vitally important materiality determination to sheer speculation.[17]

When faced with analogous application of a "might consider important" test in the securities fraud area, this Court rejected such a test as "too suggestive of mere possibility." *TSC Industries*, 426 U.S. at 449. The Tenth Circuit likewise has found the "might have" test too speculative for determining fraud on the Patent Office. It is a test which is inconsistent with this Court's rulings on the materiality requirement for fraud.

D. The Third Circuit's "Might Have" Test Imposes an Unreasonable and Unworkable Burden on Both the Patent Applicant and the Patent System

There is a vast difference between a realistic obligation to disclose facts having actual significance to the grant or denial of a patent and a requirement to divulge every piece of information which might be relevant to facts set forth in a patent application. Yet the lower court here, applying the "might have" test, held that any fact set forth

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[17] The court's opinion below is an eloquent demonstration of the speculative character of the "might have" standard:

> The Examiner *might* justifiably have placed greater weight . . . had he known . . . Similarly, *it cannot be said that the disclosures . . . would have been unimportant* to the Examiner. Moreover, had the Examiner been advised . . . *he might seriously have questioned* whether the Bolster patent should be granted . . .
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> [A-49, emphasis added].

in a patent is, *ipso facto,* "material."[18] Under this definition, information not disclosed is considered material because of what was included in the patent rather than what would be determinative of patentability. Under such a standard, disclosure of far too much information is required to ensure that the patentee will not be held guilty of fraud. This result is unfair to the patent applicant, and as recognized in *TSC Industries,* will lead to the filing in the agency of "an avalanche of trivial information . . . hardly conducive to informed decisionmaking." 426 U.S. at 448-49.

Moreover, because the "might have" test looks to the mere possibility of an effect upon the patent examiner, it has given rise to the concept that "[a] party who withholds information does so at its own risk since it is ultimately the duty of the [Patent Office], and not of the applicants and their attorneys, to determine what information is relevant."[19] The courts below applied this concept in refusing to consider the good faith, accurate judgment of the Grefco inventors that the two 1967 tests on 3/4" perlite board composites not disclosed to the Patent Office were inconclusive and invalid. The court below stated that the "most important" reason for ignoring Grefco's opinion of the tests was:

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[18] The court stated that "if [patent] Examples 1-4 were really as immaterial to patentability as now urged by Grefco, there presumably would have been no reason for their inclusion in the application" [A-49, n.40].

[19] *Standard Oil Co.* v. *Montedison, S.p.A.*, 494 F.Supp. 370, 437 (D. Del. 1980), cited by the trial court [A-32]. This requirement for submission of all information without exercise of judgment by applicant or attorney is an integral part of the "might have" test of materiality. *See* In re Multidistrict Litigation Involving Frost Patent, 398 F.Supp. 1353, 1369 (D. Del. 1975), adopted, 540 F.2d. 601, 604, n.9 (3d Cir. 1976); SCM Corp. v. Radio Corp. of America, 318 F. Supp. 433, 449-50 (S.D.N.Y. 1970).

> . . . any doubts the inventors had about the validity of the tests of 3/4" perlite board composites should have been disclosed to the Examiner for *his* determination. . . . Instead, Grefco chose to usurp the function of the Examiner when it withheld test results because they were, *in its view*, "inconclusive" [cite to transcript of trial omitted] or invalid [A-48, emphasis the court's].

This Court specifically rejected such reasoning in *TSC Industries*, 426 U.S. at 462-63, and in accordance with *TSC Industries*, there must be a finding that *in fact* the 3/4" perlite board composite fails the UL tunnel test and does not have the properties Grefco ascribed to it.[20]

Similarly, the trial court discounted the Grefco attorney's belief that he had disclosed the substance of the JCP article. The trial court criticized the Grefco's attorney's summary as slanting the JCP disclosure toward the Grefco theory of patentability — that the urethane/perlite composite was superior to combinations of urethane/fiber board or urethane/fiberglass [A-38-9, n.24]. However, Grefco's theory of patentability based on the product's superior properties was never found to be factually in error. The product admittedly *is* superior. Under *TSC Industries*, materiality, hence fraud, requires some showing that the properties at issue were in fact not superior. *Id.*

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[20] Had Grefco disclosed the fact that the two test samples failed, it also would have disclosed that other samples passed the UL tunnel test, that small scale tests suggested by Underwriters Laboratory (UL) to correlate with the UL tunnel test indicated the 3/4" embodiment would pass the UL tunnel test, and that the 3/4" perlite board composite had performed sufficiently well to be selected as Grefco's and Apache's commercial product. When viewing all these facts, the examiner would not have viewed the two failed samples as determinative of patentability.

The refusal by the courts below to consider Grefco's correct appraisal of the test results and to consider the Grefco attorney's correct reliance on the superiority of the invention to distinguish the JCP article are, therefore, a direct result of application of the "might have" standard of materiality[21] and are directly contrary to the thrust of *TSC Industries.*

Had a proper standard of materiality been adopted in this case, there could have been no finding of fraud and no award of attorney fees to Kewanee. The present case is an excellent vehicle for this Court to focus solely upon the definition of materiality for patent fraud, and to resolve the conflict that exists among the circuits on this important issue of federal law.

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[21] Although the non-disclosed portions of the JCP article "might have been" of general interest to the examiner, their disclosure would not have caused the examiner to refuse to grant the patent. "[O]r other barriers" adds nothing new to the information placed before the examiner by Grefco. This language at most suggests an equivalence between prior art fiberboard and other barriers such as perlite board and fiberglass board. However, the parties stipulated that one skilled in the art, which the examiner is presumed to be, recognized such equivalence, which is self-evident from the fact that all three are known fire-resistant thermal insulation boards. Moreover, the *prima facie* equivalence of these materials in combination with foam was disclosed to the examiner in the patent application, which specifically stated: "[i]t is equally evident that other materials [fiberboard and fiberglass] which have been suggested in this type of application or which *might be considered equivalent,* have failed to achieve satisfactory performance" [A-66, emphasis added]. Notwithstanding the recognized and disclosed *prima facie* equivalence, the examiner still issued the patent.

CONCLUSION

For the reasons presented herein, a writ of certiorari should issue to review the judgment order of the Third Circuit.

Respectfully submitted,

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APPENDIX

UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

No. 80-2753

GREFCO, INC.,

Appellant

v.

KEWANEE INDUSTRIES, INC.,

Appellee

On Appeal From The United States District Court
For The District Of Delaware
C.A. No. 77-327

Argued July 24, 1981

Before: ADAMS, HUNTER and SLOVITER, *Circuit Judges*

Judgment Order

After consideration of all contentions raised by Appellant, it is

ADJUDGED AND ORDERED that the order of the district court be and is hereby affirmed. *See Grefco, Inc. v. Kewanee Industries, Inc.*, 499 F.Supp. 844 (D. Del. 1980).

Costs to be paid by Appellant.

BY THE COURT,

/s/ _____
Circuit Judge

ATTEST:

/s/ _____
Sally Mrvos, Clerk

DATED: August 3, 1981

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

Civil Action No. 77-327

GREFCO, INC.,

Plaintiff,

v.

KEWANEE INDUSTRIES, INC.,

Defendant.

William Prickett, Esq., Prickett, Jones, Elliott & Kristol, Wilmington, Delaware; Of Counsel: Tipton D. Jennings, Esq., Stephen L. Peterson, Esq., and Bruce C. Zotter, Esq., Finnegan, Henderson, Farabow, Garrett & Dunner, Washington, D.C.; attorneys for plaintiff.

Douglas E. Whitney, Esq., and George Pazuniak, Esq., Morris, Nichols, Arsht & Tunnell, Wilmington, Delaware; attorneys for defendant.

Opinion

Dated: September 12, 1980
Wilmington, Delaware

SCHWARTZ, *District Judge*

This is an action for patent infringement of United States Patent No. 3,510,391 brought by plaintiff Grefco, Inc. ("Grefco") against defendant Kewanee Industries, Inc. ("Kewanee"). Kewanee has counterclaimed for a declaratory judgment of patent invalidity, unenforceability and non-infringement.[1] Jurisdiction and venue are conferred on this

[1] Kewanee has also alleged, in Counts II and III of its amended counterclaim (Doc. No. 166), that Grefco's enforcement of its patent violates antitrust law and constitutes unfair competition. These counts have been stayed pending resolution of the matters raised by plaintiff's complaint and Count I of defendant's counterclaim.

Court by 28 U.S.C. §§1338(a), 1391(b). Trial in this matter began on March 31, 1980 and concluded on April 28, 1980. Post-trial briefing and argument was completed on June 6, 1980. This Opinion constitutes the Court's findings of facts and conclusions of law required by Rule 52(a), F.R.Civ.P.

I. BACKGROUND FACTS

Grefco, a Delaware corporation and a wholly owned subsidiary of General Refractories Co., was formerly the Mining and Mineral Products Division of Great Lakes Carbon Corp. ("GLC") and was acquired by General Refractories on or about May 16, 1966. (Stip. No. 1).[2] Although at the time of many of the events discussed throughout this Opinion plaintiff was operating as a division of GLC, it will be referred to as "Grefco" unless otherwise indicated.

Kewanee is a Delaware corporation into which Apache Foam Products ("Apache") was merged effective February 3, 1976. Historically, Apache was purchased by the Millmaster-Onyx Corporation on September 29, 1967 from Air Products and Chemical Company. It was a division of Millmaster-Onyx Corporation until September, 1974, when it was incorporated as a wholly-owned subsidiary of Millmaster-Onyx Corporation. In 1976, Apache was merged into Kewanee and Millmaster-Onyx became an independent financial group within Kewanee (Stip. No. 2).

U.S. Patent Application Serial No. 638,629 ("Bolster application") (PX-1) was filed on May 15, 1967 in the United States Patent and Trademark Office ("PTO") on behalf of Lyle R. Bolster ("Bolster"), Harlan E. Tarbell ("Tarbell") and Donald W. Mogg ("Mogg"). Armand McMillan ("McMillan"), then assistant patent counsel for GLC, pre-

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[2] "Stip. No. ____" refers to stipulations entered into by the parties in the Pre-Trial Order (Doc. No. 167), "Tr." to the trial transcript, "PX" to plaintiff's exhibits, "DX" to defendant's exhibits, and "____ Dep." to the deposition testimony of the named witness.

pared and filed the Bolster application with the knowledge and consent of General Refractories. On September 23, 1969, Patent Examiner William J. VanBalen ("Examiner") issued an Office Action indicating that all claims of the application would be allowable if amended. The minor changes suggested by the Examiner were then made and the patent issued on May 5, 1970. (PX-1; Stip. No. 32). Grefco owns the Bolster patent.

The Bolster patent is entitled "Perlite Board Bonded to Organic Plastic Foam." The claims in suit are as follows:

1. A composite board having a U value of not more than 0.2, which comprises

(a) a rigid organic plastic foam layer having a K factor not greater than about 0.4, covered on at least one of its surfaces by

(b) a perlite board having a minimum thickness of 0.6 inch, a K factor not greater than 0.45, a minimum perlite content of at least about 30% by weight and a combustible fiber and sizing content of not more than about 35% by weight, said layer being adhered to said board.

2. The board of claim 1 wherein the other surface of the foam layer is covered by a material selected from the group consisting of perlite board, roofing felt and paper.

3. The Board of claim 1 wherein the rigid foam material is selected from the thermosetting and thermoplastic materials within the class consisting of polyvinyl chloride, polyurethane, polystyrene and epoxy resins.

4. The board of claim 1 wherein the rigid foam layer has a thickness within the range of 1/2 to 2 inches.

5. The board of claim 1 wherein the perlite board has a perlite content of 50 to 90% by weight.

6. The board of claim 5 wherein the thickness of the perlite board is within the range of 3/4 to 1 inch.

7. A composite structure in the form of a sandwich consisting of

(a) a 3/4 to 1 inch thick base layer of perlite board having a perlite content of about 50 to 90% by weight and a combustible fiber and sizing content of not more than about 30% by weight:

(b) a rigid polyurethane foam layer of 1/2 to 2 inches having a density of about 1.5 to 3.5 pounds per cubic foot, and

(c) a top layer selected from the class consisting of perlite board, roofing felt and paper, said base layer and said board layer being adhered to said foam layer.

8. [Not asserted by Grefco]

9. [Not asserted by Grefco]

10. The composite structure of claim 7 wherein the rigid foam layer is foamed in place.

(PX-2 at 7/19-8/28).[3]

The objects of the Bolster patent, as set forth in the patent, are "to provide an insulating structure which overcomes the mechanical and physical disadvantages of plastic foam boards . . . [,] to provide a combustion resistant structure based on urethane foam . . . [and] to provide an insulating structure of sufficiently low heat conductance so that it can find application in conventional roof building systems, even when an unusually low U value [the overall coefficient of heat transmission through a complete roof assembly (Stip. No. 36c)] is required." (PX-2 at 2/38-45).

Kewanee manufactures a product known as Millox (DX-A; PX-370). Although its infringement of the Bolster patent was an issue at the start of the trial, Kewanee admitted infringement midway through the trial. *See* Tr. 1647. Thus, the issues remaining for disposition are the validity of the Bolster patent and whether Grefco's conduct before the PTO was fraudulent.[4]

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[3] References to the Bolster patent will be as follows: PX-2 at (column)/(lines).

[4] The Court's decision that the Bolster patent is invalid and unenforceable requires judgment for Kewanee on Grefco's allegation of *willful* infringement as well. An invalid patent cannot be infringed. *See* 35 U.S.C. § 282; 4 Chisum, *Patents* §19.02 (1980).

II. VALIDITY

A. *Presumption of Validity*

"[T]he starting point in analyzing a challenge to the validity of a patent is the presumption that the patent is valid, with the burden of demonstrating invalidity by clear and convincing proof resting on the party asserting it." *Aluminum Co. of America* v. *Amerola Products Corp.*, 552 F.2d 1020, 1024 (3d Cir. 1977); *see also* 35 U.S.C. § 282; *Tokyo Shibaura Electric Co.* v. *Zenith Radio Corp.*, 548 F.2d 88, 93 (3d Cir. 1977); *Universal Athletic Sales Co.* v. *American Gym, Recreational & Athletic Equipment Corp.*, 546 F.2d 530, 540 (3d Cir. 1976), *cert. denied*, 430 U.S. 984 (1977). When relevant prior art has not been considered by the PTO, however, the presumption of validity is weakened or overcome. *Aluminum Co. of America, supra; Hadco Products, Inc.* v. *Walter Kidde & Co.*, 462 F.2d 1265, 1272 n.33 (3d Cir.), *cert. denied*, 409 U.S. 1023 (1972); *PIC, Inc.* v. *Prescon Corp.*, 485 F.Supp. 1302, 1312 (D. Del. 1980); *Azoplate Corp.* v. *Silverlith*, 367 F.Supp. 711, 717 (D. Del. 1973), *aff'd mem.*, 506 F.2d 1050 (3d Cir. 1974), *cert. denied*, 421 U.S. 914 (1975). "[T]he degree by which the presumption is weakened depends on a balancing of the pertinence of the newly cited art against the pertinence of the art actually considered by the Patent Office." *Aluminum Co. of America, supra*, 552 F.2d at 1025.

Kewanee asserts that the most relevant art was not considered by the Examiner and that therefore the presumption of validity has been overcome. Grefco, on the other hand, contends that the art cited by Kewanee was before the Examiner during his consideration of the Bolster application, or alternatively is no more relevant than the art considered by the Examiner. The Court finds that several important items of prior art under 35 U.S.C. §102 were not considered by the Examiner and therefore the presumption of validity has been substantially weakened. Specifically, an article in the Journal of Cellular Plastics ("JCP") (DX-GA)[5] and the Apache bro-

[5] Although McMillan attempted to summarize the conclusions of the JCP article in the prior art section of the application (Tr. 1338-39), the Court finds that the most relevant portions of the JCP arti-

chure (DX-HA),[6] both not before the Examiner, add significantly to the prior art considered by disclosing a combination of urethane and perlite as roofing insulation.[7]

B. *Anticipation*

Under 35 U.S.C. §102, a patent is invalid if the invention was "anticipated" by the prior art. Under section 102(b), a patent is invalid if "the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States." In addition, section 102(a) renders a patent invalid if "the inven-

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cle, the information that fiber board and urethane combinations would "qualify" on construction tests, and the reference in a footnote of that article to the use of perlite boards as insulating barriers, were not before the Examiner. McMillan himself testified that he believed the use of fiber board as a substrate in combination with urethane foam solved the problem that had prevented the use of plastic foams directly on steel decks (Tr. 1336), and that perlite board was identified in the footnote in the JCP article. (Tr. 1343). Regardless of whether McMillan's failure to disclose such information was fraudulent, see pages 33-35 *infra*, it does affect the presumption of validity.

[6] The Apache brochure (and UL Construction No. 9 (DX-W)) is a §102 item of prior art by virtue of the Court's findings that the date of invention of the subject matter of the Bolster patent was the application filing date of May 15, 1967, *see* pages 6-9 *infra*, and that disclosures of field fabrications are pertinent prior art, *see* pages 11-14, 22 *infra*.

[7] Grefco contends that the Chamberlain patent (DX-HE), which disclosed, *inter alia*, fiber board/urethane composites, was before the Examiner since it belongs to Class 161-Subclass 161 which was searched by the Examiner. (PX-1; Tr. 3138). While it is more likely than not that the Chamberlain patent was before the Examiner, *see* Hercules v. Exxon, C.A. No. 3439, slip op. at 69 & n.282 (D. Del. July 29, 1980), the presumption of validity is still substantially affected by the Examiner's lack of access to the prior art referred to above. *See* Aluminum Co. of America v. Amerola Products Corp., 552 F.2d 1020, 1025 n.9 (3d Cir. 1977).

tion was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent." Thus, the critical inquiries in the determination of anticipation are the date of invention of the patent and an analysis of the pertinent art available prior to invention or more than one year before the application filing date.

1. *Date of Invention*

The date of invention is deemed to be the date of the filing of the patent application. *U.S. Expansion Bolt Co.* v. *Jordan Industries, Inc.*, 488 F.2d 566, 568 n.3 (3d Cir. 1973). The burden rests with the inventor to demonstrate an invention or reduction to practice prior to the time of filing. *See generally Rex Chainbelt Inc.* v. *Borg-Warner Corp.*, 477 F.2d 481, 487 (7th Cir. 1973); 1 Chisum, *Patents* § 3.08[3] (1980); 37 C.F.R. §1.131. This burden is a relatively heavy one, comparable to the burden imposed upon an alleged infringer to demonstrate prior use under §102(a). 1 Chisum, *Patents* § 3.08[3]; *United Shoe Machine Corp.* v. *Brooklyn Wood Heel Corp.*, 77 F.2d 263 (2d Cir. 1935). Moreover, the uncorroborated and undocumented testimony of the patentee is insufficient to prove invention date. *See Bell Telephone Laboratories, Inc.* v. *Hughes Aircraft Co.*, 564 F.2d 654, 657 (3d Cir. 1977), *cert. denied*, 435 U.S. 924 (1978); *Kardulas* v. *Florida Machine Products Co.*, 438 F.2d 1118, 1121 (5th Cir. 1971); *Rooted Hair, Inc.* v. *Ideal Toy Corp.*, 329 F.2d 761, 767 (2d Cir. 1964).

The Third Circuit Court of Appeals recently set forth the requirements for a reduction to practice:

> A reduction to practice "is not achieved until the inventor has sufficiently tested the prototype to prove its utility and to determine that no further refinements are necessary." *In Re Yarn Processing Patent Validity Litigation*, 498 F.2d 271, 279 (5th Cir.), *cert. denied sub nom., Sauquoit Fibers Co.* v. *Leesona Corp.*, 419 U.S. 1057 (1974). Considerable confusion exists in the cases as to when an invention has been reduced to practice. It is a legal term of art and the apparent conflict has been as-

> cribed to the differing definitions of the term. *See id.* at 282. Even when a working model has been produced, this does not necessarily connote a 'reduction to practice' within the meaning of patent law. Thus, '[w]hile it is true that reduction to practice does not require a device embodying the invention to be mechanically perfect, or a commercial success, its practical efficiency and utility must be demonstrated.' *Van Auken* v. *Cummings*, 49 F.2d 490, 492 (C.C.P.A. 1931).

DeLong Corp. v. *Raymond International, Inc.*, No. 79-1509, slip op. at 15 (3d Cir. April 14, 1980) (addressing "reduction to practice" of prior use); *see also Standard Oil Co.* v. *Montedison S.p.A.*, C.A. No. 4319. slip op. at 15-21 (D. Del. January 11, 1980). The evidence put forth by Grefco to establish an invention date prior to May 15, 1967 must be analyzed against these legal standards.

Grefco contends that products "meeting the terms of claims 1-7 and 10 were made and successfully tested no later than March 1966." (Plaintiff's Post-Trial Brief at 28). The credible testimony and documentary evidence proffered by Grefco in support of this contention, however, fall short of meeting its burden of establishing a prior invention of the product defined by the patent. While the Court finds that Tarbell made combinations of 1" perlite and urethane and submitted such products to Underwriters' Laboratories ("UL") for testing in late 1965 or early 1966 (PX-36, 37, 45), it is not convinced that these products met all the limitations of the patent's claims 1-7 and 10. For reasons set forth more fully below, *see* pages 38-39, *infra*, the Court does not believe that the composite board described in Example 2 of the patent made by Tarbell in January 1966 (Tr. 960) had a density of 3.2 lbs./cu.ft. Grefco produced no documents indicating the production of a composite board with such a density (*see* Tr. 992), and Tarbell's uncorroborated testimony, even if credible, would be insufficient to prove prior reduction to practice.

There is evidence (DX-S) that Tarbell made a composite board with a density of 3.95 lbs./cu.ft. in January, 1966.

Grefco contends that this embodiment of the patent satisfies the limitation of claim 7 that the layer of rigid polyurethane foam have a density of "about 1.5 to 3.5 pounds per cubic foot." (PX-2 at 8/15-17). Even assuming that this language permits an upper limit of more than 3.5, *see National Research Development Corp.* v. *Great Lakes Carbon Corp.*, 410 F.Supp. 1108, 1112 (D. Del. 1979), Grefco has not carried its heavy burden of demonstrating that 3.95 lbs./cu.ft. is "about" 3.5. Very little evidence on this issue was presented. (Doc. No. 192 at 39-41, 80-83). The testimony indicated that 3.95 was the "average density" of the product described in DX-S; the lower portion of the foam had a density of more than 3.95, while the upper part had a density of less than 3.95. (Tr. 750-51). The parties have stipulated that foam can be used as insulation if it has a density of 4.0 lbs./cu.ft. or less, that "high density foams" are foams with a density of greater than four lbs./cu.ft. and that "[f]oams used for thermal insulation typically had a density in the 1.8 to 2.2 lb./cu.ft. range." (Stip. No. 38; *see also* Tr. 133). Finally, Tarbell referred to the foam produced in January, 1966 as "higher density" foam made by a "vertical pour process" which would not be utilized in commercial production. (PX-37). The foregoing evidence does not demonstrate to the Court's satisfaction that a density of 3.95 is "about" 3.5. First, there is no evidence that any portion of the foam produced by Tarbell had a density of 3.5. Second, given the stipulation concerning the range of densities for thermal insulating foam, the Court is unconvinced that foam with a density of 3.95 has sufficient utility and efficiency, as compared to foam with a density of 3.5, so as to bring it within the scope of claim 7. While reduction to practice does not require the "invention" to be mechanically perfect or a commercial success, "its practical efficiency and utility must be demonstrated." *DeLong Corp.*, *supra*, slip op. at 15. For these reasons, the Court concludes that reduction to practice of the Bolster patent did not occur prior to May 15, 1967. This conclusion, as noted *supra*, brings documents such as the Apache brochure (DX-HA) and UL Construction No. 9 (DX-W) within the framework of §102(a) prior art, even

though these documents were not printed publications more than one year prior to the filing date.[8]

2. *Analysis of Prior Art*

To anticipate a patent, "[a] prior art reference must teach the very invention of the patent," *Tokyo Shibaura Electric Co., Ltd.* v. *Zenith Radio Corp.*, 404 F.Supp. 547, 558 (D. Del. 1975), *aff'd*, 548 F.2d 88 (3d Cir. 1977); *see Paeco, Inc.* v. *Applied Moldings, Inc.*, 562 F.2d 870, 875 (3d Cir. 1977); *Congoleum Industries, Inc.* v. *Armstrong Cork Co.*, 339 F.Supp. 1036 (E.D. Pa. 1972), *aff'd*, 510 F.2d 334 (3d Cir.), *cert. denied*, 421 U.S. 988 (1975), or disclose "a device substantially identical to that claimed under the terms of the patent." *DeLong Corp., supra*, slip op. at 10 (referencing "on sale" bar of §102). Further, "it must appear that every material element of the claim in question was disclosed by a single prior art reference." *Mueller Brass Co.* v. *Reading Industries, Inc.*, 352 F.Supp. 1357, 1367 (E.D. Pa. 1972), *aff'd mem.*, 485 F.2d 1395 (3d Cir. 1973); *accord, Paeco, Inc., supra*, 562 F.2d at 875.

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[8] The Apache brochure (DX-HA) contains a date of May 10, 1966. At trial, the Court admitted this exhibit into evidence as an exception to the hearsay rule, but reserved decision as to whether the May 10 date was accurate. (Tr. 2603). Upon review of the relevant portions of the deposition and trial transcripts (Tr. 2443-48; Bickford Dep. 56-60; 166-74), the Court now concludes that Kewanee has not met its burden of demonstrating that the Apache brochure was first received by a member of the public by May 14, 1966. *See* Protein Foundation, Inc. v. Brenner, 260 F.Supp. 519 (D.D.C. 1966); 1 Chisum, *Patents* § 3.04[2]. However, Grefco does not challenge the characterization of the Apache brochure as a "printed publication," and, indeed, in light of the testimony regarding the distribution of the Apache brochure (Bickford Dep. 57-58, 167-68; Snyder Dep. 54-59; Tr. 2451-56, 2562-63; DX-DT), it could not successfully do so. *See generally* 1 Chisum, *Patents* § 3.04[2]. Therefore, the disclosures of the Apache brochure will be analyzed in connection with the determination of anticipation under §102 and obviousness under §103.

In *Universal Athletic Sales Co.* v. *American Gym, Recreational & Athletic Equipment Corp.*, 546 F.2d 530 (3d Cir. 1976), *cert. denied*, 430 U.S. 984 (1977), the Third Circuit Court of Appeals cited the following standard of anticipation:

> For a prior publication to be sufficient to defeat a patent it must exhibit a substantial representation of the invention in such full, clear, and exact terms that one skilled in the art may make, construct and practice the invention without having to depend on either the patent or on his own inventive skills.

546 F.2d at 544, *citing Philips Electronic and Pharmaceutical Industries Corp.* v. *Thermal and Electronics Industries, Inc.*, 450 F.2d 1164, 1169 (3d Cir. 1971). More recently, in *Paeco, Inc.*, *supra*, that court stated:

> [w]hen a claim incorporates an improvement over a product sold prior to the critical date, which product, except for the improvement, is identical to that described in the claim, the improvement itself must be non-obvious under §103 or the whole claim is invalid [under §102(b)].

562 F.2d at 877. Thus, when a patentee makes an obvious improvement over a prior art reference, that reference is still anticipatory because the patentee has not relied on his "inventive skills."

Kewanee contends that the Apache brochure (DX-HA), the July, 1965 JCP article (DX-GA), and perlite/urethane field installations anticipate the Bolster patent. The Court turns next to these contentions.

a. *Apache Brochure (DX-HA)*

The Apache brochure states in pertinent part:

CLASS I ROOF DECK APPLICATIONS - Possible Opportunities

> At this present moment APACHE does not share in the CLASS I roof deck business; however, as many of you have been told, we expect to have FACTORY MUTUAL rated Class I insulation in the not too distant future.

I wish to suggest that you may be able to pick up some business in spite of the rating limitation. This may be particularly attractive in areas where moderately high "C" or "U" values are required and while rather acute shortages exist in normal Class I rated insulation materials. *Factory Mutual would permit use of APACHE over a minimum thickness of rated materials installed in accordance with Factory Mutual specified procedures. This required thickness is 3/4" of Perlite Type, Fiberboard, Fiberglas and Cellular Glass.*

IN APPENDIX A I have listed the effective "C" values obtained by combining 3/4" of the several rated materials with standard APACHE thicknesses. For example, one inch of APACHE combined with 3/4" Perlite Type board will give a combined "C" of 0.114 (ditto, Fiberboard), and 0.106 for 3/4" Fiberglas.

APPENDIX B lists required thickness of APACHE used with 3/4" of Class I approved materials to give "C" values corresponding to U.S. Department of Commerce No. R257-55.

We suggest that you may find exploration of the combination of products potential very worthwhile.

DX-HA (emphasis added).

Grefco contends that the Apache brochure is not anticipatory solely because it "merely suggests the possible components for several field fabrications" and because "the structures suggested in DX-HA are outside the scope of the claims of the Bolster Patent" which, in its view, is limited to factory-manufactured composite boards. (Plaintiff's Post-Trial Brief at 31). The Court finds, however, that the brochure is not limited to field fabrications and does disclose the possible combination in a factory of perlite board and urethane foam. Moreover, the Court finds that, contrary to Grefco's assertions, the Bolster patent encompasses field fabrications of urethane and perlite combinations. The brochure itself, notwithstanding Grefco's assertions to the contrary, does not either expressly or indirectly limit the product defined by the Apache brochure to a field fabrication of a complete roofing system. In fact, the brochure discusses the "C values" obtained by combining 3/4" board with Apache foam. As stipulated by the parties, C value

is "a measure of the thermal conductivity *of a given product,*" while U value, referred to in the Bolster patent (*e.g.* PX-2 at 1/13, 2/5, 2/45, 2/60, 2/65, 5/2, 7/19), is "the overall coefficient of heat transmission through a *complete roof assembly* (including insulation, built-up roofing and the roof deck)." (Stip. No. 36) (emphasis added). *See also* Tr. 1657-58. Therefore, the use of the term "C value" in the Apache brochure is evidence that it discloses a factory-made product of the type claimed by Grefco to be the subject of the Bolster patent.

To determine whether the Apache brochure, as construed by the Court, anticipates the Bolster patent, the Court must analyze the patent and determine whether the "invention" claimed is taught by the brochure. *See* pages 9-10, *supra.* As noted, Grefco contends that the invention claimed in the Bolster patent is limited to a factory-made composite of urethane and perlite boards, and does not teach the making of a field fabrication.[9] The Court finds to the contrary.

In defining the invention claimed by a patent, the patent's "claims are to be construed in the light of the specification and both are to be read with a view to ascertaining the invention." *United States* v. *Adams,* 383 U.S. 39, 49 (1966). An analysis of the claims and the specification of the Bolster patent, in light of the evidence presented at trial, leads to a finding that both

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[9] As explained several times by counsel and witnesses (Tr. 413-14, 2578-80, 2715, DX-JT; PX-377; Sullivan Dep. 76-77), a field fabrication of a urethane/perlite combination would require the following steps: placing adhesive over the steel deck of the roof, adhering perlite board to the deck, placing adhesive over the perlite board and adhering a ready made board of polyurethane foam with felt facings (DX-B) to the perlite, and applying the built-up roof (BUR) consisting of asphalt, gravel and additional layers of roofing felt. Construction of a roof utilizing a combination product such as Millox (DX-A, PX-370) or Permalite PK (Grefco's perlite and urethane combination product) requires adhering the perlite/urethane board to the steel deck and applying the BUR over the Millox and Permalite PK board.

field and factory fabrication of perlite/urethane combinations are encompassed by the Bolster patent. Grefco contends that the terms used in claims 1 and 7 to describe the invention — "composite board" and "composite structure in the form of a sandwich" — limit the invention to factory fabrication. However, Mogg himself conceded that these terms did not take on a meaning in the roofing industry limited to factory manufacture until several years after the Bolster application was filed. (Tr. 811-13; *see also* Tr. 95-96, 1673; PX-8; Bolster Dep. 270; Maroni Dep. 83-90). *Cf.* DX-HE (Chamberlain patent for "Sandwich Roofing Element"; invention is defined as "*prefabricated*" insulating element and patent claims cover "an integral roof deck and insulation panel"); PX-368 (1969 patent application by Coglianese in which invention is described as "a pre-fabricated panel"). Unlike the Bolster patent, the Chamberlain patent draws a distinction between field and factory fabrication at the outset (DX-HE at 1/11-15). Thus, the claims of the Bolster patent do not limit by definition the types of structures encompassed by the patent. *See Funnelcap, Inc.* v. *Orion Industries, Inc.*, 421 F.Supp. 700, 706-07 (D. Del. 1976).

An analysis of the specification in light of Mogg's candid testimony reinforces this finding. The patent contains the following language with respect to the making of the invention:

> The polyurethane foam can be formed and stabilized in situ on the perlite board; in this case, it serves as its own adhesive and no other bonding substance is needed. Alternately, as is the case with other usable plastic foams, ready made board of polyurethane foam can be employed, necessitating recourse to an extraneous adhesive to bond the foam board to the perlite board and to the other facing material that may be used. Any conventional adhesive suitable for the surfaces involved can be used for this purpose, asphalt emulsions and phenoaldehyde adhesives such as phenol-resorcinol-formaldehyde being typical of such well known materials.

PX-2 at 4/27-38. Mogg testified that, although he and his coinventors intended to refer to urethane foam without felt facings in the specification (Tr. 826, 1234, 1492-93), the term

"ready made board of polyurethane foam" includes foam made by Apache (DX-B) and other manufacturers which contained felt facings on both sides. (Tr. 599, 840-42; *see also* Tr. 1234, 1492-93, 2483, 2650-51). Such polyurethane foam board (DX-B) was one of the four main insulating boards in use at the time of the Bolster application. (Tr. 63, 629, 655). Thus, the patent envisions the use of an adhesive to combine a urethane board with felt facings with a perlite board. (*See* Tr. 622-23). This is exactly what is done in a field fabrication. *See* note 9 *supra*. In fact, Mogg conceded, under questioning by the Court, that "as to where the patent draws the line between a factory and doing it in some cruder fashion, I am not really quite sure."[10] (Tr. 818; *see also* Tr. 620). The Court therefore concludes that the Apache brochure, whether or not limited to a field fabrication, anticipates the Bolster patent.[11]

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[10] Mogg testified that if perlite board and "readymade board of polyurethane foam" were glued together with asphalt emulsion "in a manufacturing operation," it would come within the Bolster patent, despite the presence of an adhesive and a layer of roofing felt (Tr. 617-18), and despite his prior testimony that the patent was not intended to cover "taking a premade urethane board and adhering that to the perlite board with asphalt." (Tr. 96). As Mogg conceded, however, the patent is silent with respect to place of manufacture of the product. (Tr. 659, 678-79). Moreover, inasmuch as the patent claims a *product* and not a *process* for making the product (Tr. 1348, 3142), the distinction consistently urged by Grefco — that between field and factory fabrication — is insignificant. *See* Johnson & Johnson v. W. L. Gore & Associates, Inc., 436 F.Supp. 704, 726 (D. Del. 1977).

[11] As noted, Grefco's sole contentions with respect to the Apache brochure were that it disclosed only a field fabrication and "merely suggested" the use of perlite board. Since an anticipatory piece of prior art must disclose every material element of the patent's claims, Grefco presumably believes either that the claims' limitations are not "material" or that the brochure disclosed such limitations to those of ordinary skill in the art. *See* Stip. Nos. 12, 57(5); PX-2 at 3/10-14.

b. *Journal of Cellular Plastics, July 1965*

The July, 1965 Journal of Cellular Plastics ("JCP") contains an article entitled "Cellular Plastics in Construction Applications and Fire Protection." (DX-HD). Among the authors of this article is Fred Coglianese, a Kewanee employee, who was with Johns Manville Products Co. at the time of publication. Kewanee asserts that a section of this article, written by Coglianese (Stip. No. 76; Tr. 1711-12), anticipates the Bolster patent. That section reads:

> Roof Deck Insulation — Plastic foams are used [as] roof deck insulation because of low heat transmission, high impact resistance, high compressive strength, low water-vapor transmission and low installation costs. The foams are bonded to metal, wood, concrete or gypsum decks and then topped by a standard built-up roof. In many applications, this system is readily accepted and its use presents no problem. In certain large area industrial applications, however, special precautions are necessary to achieve a system with suitable fire behavior. The major consideration is when a fire exists in an area below the roof. If combustibles in the roof become available fuel, the existing fire is worsened and a spreading, self-perpetuating fire results. Because of their heavy fire resistive nature, concrete and gypsum decks post no problem in this area. Metal decks, however, must be of special construction in order to meet safety requirements.
>
> Several large scale tests have been developed to determine suitable safety standards for metal roof deck assemblies.(*) See Section titled Test Methods.

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* Suitable decks are listed in Section 360 RO of the UL Building Materials list. Briefly, the following constructions have been accepted:

1. Steel Deck — 1" vegetable fibre board — limited, special adhesive — built-up roof.
2. Steel Deck — 1" mineral fibre board, etc.
3. Steel Deck — 1" expanded perlite, etc.
4. Wood Deck — 3/4" tongue and grooved Douglas fir plywood, 0.002" aluminum sheet — 1" vegetable fibre board, etc.
5. Wood Deck — 1" tongue and grooved Douglas fir lumber — 0.002" aluminum sheet — 1" vegetable fibre board, etc.

DX-HD at 360-61 (emphasis added).

> In all of these construction tests, an insulating barrier must be imposed between deck and roof. *Plastic foams that offer no resistance under fire conditions would require one inch of fiber board or other barrier over the deck and under the foam in order to qualify.*
>
> In conclusion it can be stated that:
>
> a. In many applications, plastic foams offer excellent service in roof decks and are fully accepted.
>
> b. *Plastic foams are not suitable for steel deck unless underlaid by a barrier such as fiber board.* No problem exists with concrete and gypsum decks.

Once again, Grefco contends that the JCP article "does nothing more than suggest or infer . . . that other unnamed materials could be used in combination with urethane foam in a field fabrication . . .. What materials could be used is left to the reader." (Plaintiff's Post-Trial Brief at 32 (citations omitted)). However, Coglianese, a man conceded by Grefco to be of ordinary skill in the pertinent art of rigid thermal insulation (Tr. 1717, 1723, 1730-39), testified that, although the use of perlite board is not expressly disclosed by the article, "to someone with knowledge, to me" the reference to "fiber board or other barrier" would teach that perlite board and urethane foam could be combined in a steel deck roof assembly. (Tr. 1722). The article itself refers in the footnote to a list of "suitable decks" taken from Section 360 RO of the UL Building Materials List. Construction Nos. 1 and 2, the first two such decks listed in the footnote, may contain perlite board as an approved insulation board, a fact known to those of ordinary skill in the art. (Stip. Nos. 17, 18, 21, 22; *see also* DX-JG).[12] Earlier in the article, it is stated that test roof deck systems listed in Section 360 RO are those which "pass" the UL

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[12] Construction No. 3 in footnote (*) refers to "1-1/4" expanded perlite, etc."; this is not a reference to perlite board, but rather to a mixture of asphalt and perlite known as "all-weather Crete." (Tr. 386, 1714; DX-JG at 456). McMillan testified, however, that he believed this footnote referred to perlite *board*. (Tr. 1343). *See* page 34 *infra*.

tunnel roof deck test. (DX-HD at 357). Given the inclusion of perlite board as an insulating component of UL Constructions 1 and 2, the Court concludes that the statement that "plastic foams that offer no resistance under fire conditions would require one inch of fiber board or other barrier over the deck and under the foam in order to qualify" discloses to a person of ordinary skill in the art of rigid thermal insulation the combination of urethane and perlite boards. Finally, for the reasons stated at pages 12-14 *supra*, Grefco's attempt to distinguish the JCP article because it teaches a field fabrication fails. Under the standard of anticipation in this Circuit, then, the JCP article anticipates the Bolster patent. *See Universal Athletic Sales Co., supra,* 546 F.2d at 544; *Paeco, Inc., supra,* 562 F.2d at 875; *Johnson & Johnson* v. *W. L. Gore & Assoc., Inc.,* 436 F.Supp. 704, 726 (D. Del. 1977). *See also* Tr. 32123-16 (Testimony of C. Marshall Dann, former Commissioner of Patents and an expert trial witness for Grefco, that if one skilled in the art would read "fiber board or other barrier" as including perlite, then JCP article discloses combination of perlite and urethane).

c. ***Actual Field Fabrications of Perlite Board and Urethane Foam***

Kewanee presented evidence at trial in an attempt to prove that perlite board was used in combination with urethane foam as roofing insulation in field fabrications prior to the Bolster application. If true, these field fabrications would constitute an invalidating "prior use" of the invention under sections 102(a) and (b). Kewanee, however, has not satisfied its "heavy burden" of proving such prior use. *See* page 6 *supra;* 1 Chisum, *Patents* § 3.05.[2]c. Although several witnesses testified that they were generally aware of such fabrications (Tr. 1668, 2739-44, 2503-04; Bolster Dep. 166; Sullivan Dep. 176-80), there was no direct testimony as to specific applications of urethane foam over perlite board. *See* PX-378 (Answer to Interrog. No. 202). Kewanee concedes that a partial roof of urethane and perlite constructed at Johns-Manville in the mid-1960's was experimental and not a prior use under section

102. (Tr. 2748). The overall evidence proffered by Kewanee falls far short of demonstrating that field fabrications anticipated the Bolster patent.

C. *Obviousness*

Even assuming *arguendo* that the Bolster patent is not anticipated by the Apache brochure and the JCP article, the Court concludes that the invention was obvious from the pertinent prior art and therefore the patent is invalid under 35 U.S.C. §103.[13]

In the landmark case of *Graham* v. *John Deere Co.*, 383 U.S. 1 (1966), the Supreme Court addressed for the first time the tests to be employed by the courts in determining obviousness under §103. The Court's often-quoted language is as follows:

> While the ultimate question of patent validity is one of law, . . ., the §103 condition, which is but one of three conditions, each of which must be satisfied, lends itself to several basic factual inquiries. Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure to others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

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[13] 35 U.S.C. §103 reads:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

383 U.S. at 17-18 (citations omitted). *See also American Sterilizer Co.* v. *Sybron Corp.*, 614 F.2d 890 (3d Cir. 1980); *Sims* v. *Mack Truck Corp.*, 608 F.2d 87 (3d Cir. 1979); *Paeco, Inc.* v. *Applied Moldings, Inc.*, 562 F.2d 870 (3d Cir. 1977); *Tokyo Shibaura Electric Co. Ltd.* v. *Zenith Radio Corp.*, 548 F.2d 88 (3d Cir. 1977).

1. *Scope and Content of the Prior Art*

Several items of prior art, the Apache brochure and the JCP article, have already been analyzed. At a minimum (even assuming Grefco is correct in its contention that the Apache brochure teaches only a field fabrication and that the JCP article does not disclose the use of perlite in combination with urethane), these publications teach the combination of perlite or fiber board with urethane foam in a field fabrication. Another item of prior art, UL Construction No. 9 (DX-W), also teaches the operability of a field fabrication of urethane foam and fiber board. In addition, DX-HE, Patent No. 3,111,787, issued to Chamberlain in 1963, discloses the invention of prefabricated insulating roofing elements utilizing a "self-adhering" insulated core of foamed plastic, including polyurethane. (DX-HE at 1/29-46). According to the patent, the foamed plastic core may be adhered to the rigid facings identified (plywood, hardwood board, vegetable fiber board, cement asbestos board, aluminum, steel, gypsum board (DX-HE at 2/10-12) either by preforming the foamed plastic core over the board or by utilizing a bonding adhesive. (DX-HE at 1/29-32, 2/3-6, 3/46-49). DX-GD, a DuPont brochure dated March 29, 1961, discloses the manufacture of wall panels with "cores of rigid urethane foam." This publication states that "[a]lmost any facing material can be used with rigid urethane foam cores" and that such panels may be made by "the foamed-in-place technique" which "has been discussed in Foam Bulletins of October 28, 1960 and January 16, 1961." (DX-GD at 1, 2).

Grefco presented evidence that the prior art was concerned with making urethane foam fire-resistant, *see* Tr. 72-73, 81; PX-81, PX-341; Stip. No. 57(2). The Court finds that there

were those in the roofing industry who were attempting to solve the problem of foam's susceptibility to heat damage (Stip. No. 57(1)) by the formulation of fire resistant foam. However, a second, and eventually successful, focus of the industry was the use of rigid thermal barriers to protect urethane foam from heat damage. It is this body of prior art which renders the Bolster patent obvious.

2. *Differences Between the Prior Art and the Claims at Issue*

Even if the claims of the Bolster patent are construed to cover only a prefabricated composite of urethane and perlite boards,[14] the differences between the teachings of the prior art and the patent are few. A field fabrication contains an extra layer of roofing felt between the urethane and perlite boards as well as an adhesive with which to bond the two boards together. *See* note 9 *supra* (Tr. 371, 415, 607-08). However, claims 1 and 7 and dependent claims 2-6 specify adhesion of the perlite board to the foam. (PX-2 at 7/28-29, 8/19-21). Since the specification teaches the use of an "extraneous adhesive," the claims must be interpreted to include a bonding substance, *see* Tr. 3153,[15] leaving the layer of felt between the urethane and perlite boards as the only difference between the Bolster patent and a field fabrication of urethane foam and perlite board as taught by the prior art.[16]

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[14] It is arguable that claim 7, as limited by its dependent claim 10, excludes field fabrications because of the requirement that the rigid foam layer be "foamed in place." *See* Tr. 3156. Assuming this is true, claim 10 is still invalid as obvious for the reasons set forth below. See pages 21-22 *infra*.

[15] Mogg and Tarbell both testified that, in their testing of composite products, the use of an adhesive had no effect on the combustibility of the product. (Tr. 670, 681-82, 901).

[16] It is noted that Grefco, in the section of its brief entitled "The Differences Between the Claimed Invention and the Prior Art," devotes the entire discussion to arguing why the Bolster patent does not encompass field fabrications. (Plaintiff's Post-Trial Brief at 37-39). It does not attempt, however, to rebut Kewanee's assertion and

3. *Level of Ordinary Skill in the Pertinent Art*

In determining the hypothetical person skilled in the pertinent art, the Court must look to those in the industry attempting to solve the problems addressed by the invention and not to the subsequent users of the invention. *See Systematic Tool & Machine Co.* v. *Walter Kidde & Co., Inc.*, 555 F.2d 342 (3d Cir.), *cert. denied*, 434 U.S. 857 (1977); *Universal Athletic Sales Co.*, 546 F.2d 530 (3d Cir. 1977), *cert. denied*, 430 U.S. 984 (1977); *Komline-Sanderson Engineering Corp.* v. *Ingersoll-Rand Co.*, 485 F.Supp. 973 (D. Del. 1980). The parties agreed at trial that the relevant art for purposes of determining validity under §103 is the art of "rigid thermal insulation." (Tr. 1734-38). Further, Grefco agreed that Fred Coglianese was a man of ordinary skill in this art. (Tr. 1717, 1724-25).

The Court finds that a person of ordinary skill in the pertinent art would be conversant with the chemistry involved in making and bonding foam to fire-resistant barrier boards and would have worked for a company making roofing insulation products. As noted *supra*, considerable attention was being devoted by the industry to reducing the fire risks attendant upon the use of urethane foam, which was recognized as an excellent thermal insulator. (Stip. No. 57(1)). Many of those in the industry were attempting to combine urethane with other, more fire-resistant barriers to form insulating structures, *see* Stip. Nos. 57(3), (9), and Johns-Manville had actually installed an experimental partial roof of urethane and perlite before the filing of the Bolster application. (Tr. 2748). The Court finds that these attempts to solve the problem ad-

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evidence that the two additional components of a field fabrication as compared to foamed-in-place boards — felt and adhesive — are insignificant. *See* pages 21-23 *infra;* Tr. 2711-12.

As noted by the Third Circuit Court of Appeals In Re Multidistrict Litigation Involving Frost Patent, 540 F.2d 601, 609 (3d Cir. 1976):

> The advocate's mind is quick to fasten on a distinction . . ., often forgetting or avoiding inquiry into whether that distinction makes a significant difference.

dressed by the Bolster patent (see PX-2 at 1/13-15; 1/38-45; 2/38-45) are very probative of the level of skill in the art of rigid thermal insulation.

4. *Analysis*

(a) *Graham Primary Tests of Obviousness*

Under the "practical test of patentability" established by the Supreme Court in *Graham*, the Court must consider the factual findings made above and reach a conclusion of law as to obviousness. 383 U.S. at 17. This analysis leads inexorably to a conclusion that the Bolster patent is invalid as obvious under 35 U.S.C. §103.

As found at page 20 *supra*, the only possible differences between a field fabrication and a factory-made, foamed in place composite of urethane foam and perlite board are the addition of a layer of roofing felt and adhesive between the two layers in the field. These are not patentable differences. In *Paeco, Inc.* v. *Applied Moldings, Inc.*, 562 F.2d 870 (3d Cir. 1976), the Third Circuit Court of Appeals addressed the validity of a patent for "replica wooden beams" made of foamed urethane. The only difference between the beams claimed in the patent and prior art beams was the removal of a skin from the surface of the beam so as to facilitate the mounting of the beam to ceilings. The court affirmed the district court's conclusion that "the idea of removing the skin of a urethane foam beam for the purpose of making it easier to glue the beam to the ceiling would have been obvious to a person with ordinary skill in the art." 562 F.2d at 878. Similarly, in the instant case, given the testimony and other evidence regarding the known self-adhering properties of urethane foam when applied directly to other boards (*see* Tr. 103, Sullivan Dep. 45, PX-8, PX-15, DX-HE, DX-IE), the prior disclosure of the "foamed-in-place technique" (DX-GD, DX-TP, DX-JK at 235-39), and the efforts of others in the industry to manufacture foamed-in-place composite structures of perlite and urethane in a factory prior to the filing of the Bolster application (Tr. 2476-80, 2511, 2642-45; PX-70), the Court is compelled to conclude that the

Bolster "invention," even if limited to a factory-made composite as arguably defined by claim 10, was obvious.

In addition, the Court finds the use of perlite board in combination with urethane foam obvious from the prior art disclosures of fiber board and urethane composites. Bolster conceded that the industry would have looked, in 1965-66, to materials already rated for use over a metal deck as the most likely candidates for the substrate between a metal deck and a plastic foam. (Bolster Dep. 246; *see also* Tr. 2644, Maroni Dep. 96-97). These materials were fiber board, fiberglass, foamed glass, mineral wool board and perlite board. (DX-HG, Tr. 69). Mogg and Nash both testified that perlite was even less combustible and more fire-resistant than fiber board. (Tr. 685, 2520; *see also* Tr. 1061). Moreover, Coglianese, a man of ordinary skill in the art, testified that, to the roofing industry, perlite and fiber board were "interchangeable" (Tr. 1669-70), and Mogg himself conceded that fiber board was considered equivalent to perlite in the roofing industry. (Tr. 637, 713). Thus, the Court finds it would have been obvious to a person of ordinary skill in the art to combine perlite board with urethane foam in an effort to make a fire-resistant insulating product.[17]

(b) *Secondary Tests*

In *Graham*, the Supreme Court articulated several so-called "secondary considerations," such as "commercial success, long felt but unsolved needs, failure of others," which "may have relevancy" to the determination under §103. 383 U.S. at

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[17] In light of the interplay between §§102 and 103, the Court's findings under §103 that factory production of a urethane and perlite composite was obvious from the prior art field fabrications and that the use of perlite board was obvious from the prior art references to fiber board and urethane combinations renders the Bolster patent invalid under §102 over the Apache brochure and the JCP article even if these references do not directly anticipate the Bolster patent. *See* Paeco, Inc. v. Applied Moldings, Inc., 562 F.2d 870, 877-78 (3d Cir. 1977).

17. Grefco relies heavily upon these secondary considerations as evidence of nonobviousness. (*See e.g.*, Plaintiff's Post-Trial Brief at 37, 39, 41-42). While these criteria have often engendered confusion, *see generally*, Witherspoon, *Nonobviousness — The Ultimate Condition of Patentability*, at 2:501-18 (1980), the Third Circuit Court of Appeals has articulated the weight to be accorded such factors:

> [T]hese secondary considerations are entitled to 'only measured weight' in adjudging obviousness, *U.S. Expansion Bolt Co.* v. *Jordan Industries, Inc.*, 488 F.2d 566, 572 (3d Cir. 1973); *Frank W. Egan & Co.* v. *Modern Plastic Machinery Corp.*, 387 F.2d 319, 327 (3d Cir. 1967), *cert. denied*, 391 U.S. 966, 88 S.Ct. 2036, 20 L.Ed.2d 879 (1968), and they cannot, by themselves, support a finding of nonobviousness if it is otherwise established that a patent's disclosures are obvious in light of the prior art. *Continental Can Co.* v. *Crown Cork & Seal Co.*, 415 F.2d 601, 602 (3d Cir. 1969), *cert. denied*, 397 U.S. 914, 90 S.Ct. 916, 25 L.Ed.2d 94 (1970).

Tokyo Shibaura Electric Co. v. *Zenith Radio Corp.*, *supra*, 548 F.2d at 94-95. *Accord, Aluminum Co. of America* v. *Amerola Products Corp.*, *supra*, 552 F.2d at 1025-26.

In the instant case, the Court finds that the secondary considerations reinforce its previous conclusion of obviousness. Apache's urethane/perlite board product, Millox, first joined the roofing insulation market in 1969. (Tr. 2699, DX-DX, PX-359). According to Nash and Coglianese, there was no long felt need or want at that time for a composite product of this type. (Tr. 2527, 2700-01). This was due to the fact that "very few" specifications required insulation as thick and as thermally efficient as Millox. (*Id.; see also* Tr. 2508-13). Similarly, the commercial success currently enjoyed by Millox (Tr. 2703-05, Stip. No. 84; PX-360) first came about in 1973 when the energy shortage created a need for more energy-efficient roofing insulation. (Tr. 2702-03). "Commercial success provides a basis for inferring nonobviousness only when the success is attributable to the feature which is the subject of the patent claim." 2 Chisum, *Patents* § 5.05[2] at 5-247; *Marconi Wireless Tel. Co.* v. *United States*, 320 U.S. 1, 35 n.20 (1943).

Contrary to any evidence of "failure of others," there is evidence of prior independent development of both factory-made composite and field fabrications of perlite and urethane, *see* pages 17, 22 *supra*. While this activity may not be §102 prior art, it is entitled to some weight as a secondary factor showing obviousness. *See Graham* v. *Jeoffroy Mfg., Inc.*, 206 F.2d 769, 771 (5th Cir. 1953); *Schimizzi* v. *Chrysler Corp.*, 462 F.Supp. 630, 639 (S.D.N.Y. 1978); 2 Chisum, *Patents* § 5.05[7].

Finally, Grefco relies on both Apache's repeated praise of its Millox product (*see* PX-186, 285, 301, 350, 351) and Coglianese's unsuccessful attempt to patent a composite of perlite and urethane (*see* PX-368) as "significant and persuasive evidence that the invention defined in the claims of the Bolster Patent was non-obvious." (Doc. No. 176, Plaintiff's Proposed Conclusions of Law ¶ 8). *See also* Plaintiff's Post-Trial Brief at 29, 41-42, 45). While there is authority emanating from the Seventh Circuit Court of Appeals supporting this proposition, *see Reynolds Metals Co.* v. *Aluminum Co. of America*, 457 F.Supp. 482, 496, 507 (N.D. Ind. 1978), *rev'd on other grounds*, 609 F.2d 1218 (7th Cir. 1979); *Tracor, Inc.* v. *Hewlett-Packard Co.*, 519 F.2d 1288, 1307 (7th Cir. 1975), this Court is of the view that such evidence is entitled to very little, if any, weight on the issue of obviousness. The primary test to be employed by the courts in determining validity under §103 is the three-prong *Graham* test. An alleged infringers' statements in annual reports and advertisements or its efforts to obtain a patent on the product can not override overwhelming proof of obviousness under both the three-prong *Graham* test and the other secondary considerations.

c. *The Patentability of Combination Patents*

As conceded by Grefco, the Bolster patent claims "a composite board made from known materials." (Tr. 1293-96; see Bolster Dep. 22). Indeed, there can be no dispute that both perlite board and urethane foam were well-known materials in the roofing insulation industry at the time of the Bolster application. There is also no dispute that a person having ordin-

ary skill in this art would have known that urethane was an excellent thermal insulator but was susceptible to damage or degradation when exposed to heat and that perlite board was flame resistant as well as a thermal insulator. Stip. Nos. 5 (1), (5). Thus, in combining these two products, the Bolster patent sought to obtain a fire resistant, thermal insulating product. (*See* PX-2 at 1/13-15, 2/38-45).

Although there is some confusion in the law as to whether combination patents should be analyzed for obviousness under a standard different from that set forth in *Graham, see generally* Witherspoon, *supra,* at 7:306-310; 2 Chisum, *Patents,* § 5.04[5], there is no question that such patents have long been subject to the most careful scrutiny. *See Great Atlantic and Pacific Tea Co.* v. *Supermarket Equipment Corp.,* 340 U.S. 147 (1950). In *Anderson's-Black Rock, Inc.* v. *Pavement Salvage Co.,* 396 U.S. 57 (1969), the Supreme Court, in invalidating a patent on a combination radiant heat burner and a paving machine, stated:

> The combination of putting the burner together with the other elements in one machine, though perhaps a matter of great convenience, did not produce a 'new or different function,' . . . within the test of validity of combination patents.
>
> A combination of elements may result in an effect greater than the sum of the several effects taken separately. No such synergistic result in argued here.

398 U.S. at 60-61. More recently in *Sakraida* v. *Ag Pro, Inc.,* 425 U.S. 273 (1976), the Court invalidated a patent containing a combination of 13 old elements, and stated:

> We cannot agree that the combination of these old elements . . . can properly be characterized as synergistic, that is, 'result[ing] in an effect greater than the sum of the several effects taken separately.'' *Anderson's-Black Rock* v. *Pavement Co.,* 396 U.S. 57, 61 (1969). Rather, this patent simply arranges old elements with each performing the same function it had been known to perform, although perhaps producing a more striking result than in previous combinations. Such combinations are not patentable under standards appropriate for a combination patent . . .

> Though doubtless a matter of great convenience, producing a desired result in a cheaper and faster way, and enjoying commercial success, [the patent] "did not produce a 'new or different function' . . . within the test of validity of combination patents." *Anderson's-Black Rock* v. *Pavement Co., supra,* at 60. These desirable benefits 'without invention will not make patentability.' *Great A. & P. Tea Co.* v. *Supermarket Corp.,* 340 U.S. at 153. *See Dann* v. *Johnston* [425 U.S.] at 230 n.4.

425 U.S. at 282-83.[18]

The Third Circuit Court of Appeals recently declined to rule whether a finding of synergism is a precondition to validity in all cases involving combination patents, *Sims* v. *Mack Truck Corp.,* 608 F.2d 87, 93 (3d Cir. 1979), and in light of this Court's finding that the Bolster patent is invalid under the *Graham* test, this issue need not be decided. It is noted, however, that the two elements of the Bolster patent, urethane and perlite, each perform "the same function it had been known to perform." The "new and useful result" claimed by Grefco — "a unitary product needing no further assembly at the job site that is both thermally efficient and fire-resistant"[19] — (Plaintiff's Post-Trial Brief at 42), while no doubt "a matter of great convenience," *Sakraida, supra,* at 282, is not patentable.[20]

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[18] *See also* Roanwell Corp. v. Plantronics, Inc., 429 U.S. 1004 (1976) (denial of certiorari) (White, J. dissenting):

> to be patentable, a combination of elements must produce something more than the sum of the pre-existing elements; there must be a synergistic result that is itself nonobvious.

429 U.S. at 1006.

[19] As found *supra,* the Bolster patent in actuality is not limited to the product described by Grefco. *See* pages 12-14 *supra.*

[20] Perhaps in an effort to demonstrate "synergism," Tarbell was asked whether "a composite product of plastic foam and perlite board [has] overall properties not obtainable by the use of its single components." (Tr. 891). Not surprisingly, Tarbell responded by stating that a combination of perlite and urethane does contain properties not found in either perlite or urethane alone. The combina-

Application of the three-prong *Graham* test, consideration of the secondary factors set forth in *Graham* and an analysis of the patentability of combination patents all lead to the inescapable conclusion that the Bolster patent is invalid as obvious under 35 U.S.C. §103.

III. GREFCO'S CONDUCT BEFORE THE PATENT OFFICE

Kewanee contends that Grefco's prosecution of the Bolster patent before the PTO involved fraudulent conduct, thereby rendering the patent invalid and unenforceable. Its contention addresses essentially two sections of the patent application: misrepresentation or omission of the most pertinent prior art (PX-2 at 1/29-2/36) and misrepresentation and concealment of the results of experiments and tests referenced in examples 1-6 (PX-2 at 4/45-7/8).

A. *The Legal Standards*

Kewanee has the burden of proving Grefco's fraud "clearly, unequivocally and convincingly." *In Re Multidistrict Litigation Involving Frost Patent*, 540 F.2d 601, 603 (3d Cir. 1976) (hereinafter *"Frost"*); *DeLong Corp.* v. *Raymond International, Inc.*, No. 79-1509, slip. op. at 20 (3d Cir. April 14, 1980). There are two necessary elements of a finding of fraud. The alleged infringer must first prove that the omission or misrepresentation was "material" in the sense that it made it "impossible for the Patent Office fairly to assess the patent application against the prevailing statutory criteria." *Frost, supra*, 540 F.2d at 604 n.9, *citing Monsanto Co.* v. *Rohm & Haas Co.*, 456 F.2d 592, 600 (3d Cir. 1972). Second, the patentee must possess "an affirmative intent to deceive or at least a gross negligence or recklessness in misrepresentng the truth." *DeLong Corp., supra* slip op. at 20.

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tion, he testified, has better insulating capability than perlite and better fire resistance than urethane. (Tr. 891-93). However, there was no evidence that perlite board and urethane foam, when used in combination with one another, perform a function different from that which they were known to perform individually.

Participants in proceedings before the PTO are held to high standards of conduct because of the *ex parte* nature of such proceedings, *see generally PIC, Inc.* v. *Prescon Corp.*, 485 F.Supp. 1302, 1309-10 (D. Del. 1980), and because of the Patent Examiner's relative inability to test the veracity of certain representations made to him. *Frost, supra*, 540 F.2d at 611 n.36; *Norton* v. *Curtiss*, 433 F.2d 779, 793-94 (C.C.P.A. 1970). *See Hercules* v. *Exxon*, C.A. No. 3439, slip op. at 64 (D. Del., July 29, 1980); Tr. 2951-52.

In *Standard Oil Co.* v. *Montedison, S.p.A.*, 540 F.2d 611 (3d Cir. 1976), the Third Circuit Court of Appeals wrote,

> one who prosecutes an application for a patent must meet the highest standards of conduct in dealing with the Patent Office. An applicant who seeks to obtain a patent for his invention is asking the government for the grant of a monopoly which concerns not only other private parties who may also be claiming the same invention, but which involves issues of great moment to the general public as well. The circumstances surrounding such a proceeding must be wholly free from fraud and other inequitable conduct.

540 F.2d at 616.

This Court has recently stated that "[a] party who withholds information does so at its own risk since it is ultimately the duty of the [Patent Office], and not of the applicants and their attorneys, to determine what information is relevant." *Standard Oil Co.* v. *Montedison S.p.A.*, Cons. C.A. No. 4319, slip op. at 150 (D. Del., January 11, 1980). The Court went on to explain,

> '(i]t is the province of a patent examiner, and not a party, to determine what data is relevant and to elicit it from the parties. When requested to do so, the parties must supply available information. Although a party may subsequently attack such information as unfair or irrelevant, *it cannot attempt to perform the examiner's function by determining the validity of its own case.*"

Id., slip op. at 169 (emphasis added).

At the same time, this Court and the Third Circuit Court of Appeals have consistently recognized that patent applicants and their attorneys are not held to an absolute, inflexible duty of disclosure in their dealings with the PTO. In *Johnson and Johnson* v. *W. L. Gore & Associates, Inc.*, 436 F.Supp. 704 (D. Del. 1977), Judge Wright stated,

> The applicant should be accorded the right to exercise good faith judgment. Only when he is guilty of fraud, willfulness or recklessness indicating a disregard for his duty of candor should enforcement of the patent be barred. *Xerox Corp.* v. *Dennison Mfg. Co.*, 322 F.Supp. 963, 968-69 (S.D.N.Y. 1971). As Judge Stapleton expressed in *Tokyo Shibaura, supra* [*Tokyo Shibaura Electric Co., Ltd.* v. *Zenith Radio Corp.*, 404 F.Supp. 547 (D. Del. 1975), *aff'd*, 548 F.2d 88 (3d Cir. 1977)]:
>
> > A patent attorney has no absolute duty to perceive that which one skilled in the art would have perceived if left in a room to study a display of all the prior art. His duty is one of candor and this duty leaves room for the exercise of good faith judgment even if that judgment ultimately is held to have been faulty. 404 F.Supp. at 569.

436 F.Supp. at 732.

In *DeLong Corp., supra*, the Third Circuit Court of Appeals held that

> without more the mere misstatement in the patent application that there had not been a prior sale of the invention for more than one year prior to the date of the application, particularly when the circumstances pertaining to the transaction required a sifting of the facts, will not support a finding of fraud . . . .

Slip op. at 21.

It is against this legal framework that Kewanee's allegation of fraud must be examined.

B. *Prior Art Section*

Kewanee contends that McMillan fraudulently misrepresented the state of the art in the prior art section of the Bolster

application. Specifically, it cites his alleged failure to disclose that perlite board and rigid urethane foam were among the four leading roofing insulation boards in commercial use prior to the application and his failure to disclose the substance of the JCP article which indicated that fiber board and urethane combinations "qualified" on industry construction tests and which, it has been found herein, constituted a disclosure of perlite board and urethane foam to a man of ordinary skill in the art. Grefco contends that McMillan's description of the prior art was "fair and adequate."

In the prior section of the Bolster patent, McMillan did not refer the Examiner to specific pieces of prior art, but rather attempted to summarize developments in the roofing industry and the findings or teachings of several publications. (Tr. 1214, 1235, 1329). The discussion of urethane foam states that "[r]igid plastic foam boards are unusually good thermal insulators and have thus found wide and varied use in industry" (PX-2 at 1/29-31) and that "[u]rethane foam board, in particular, exhibits unusually low thermal conductivity and is for that reason the preferred plastic foam material of the building industry." (PX-2 at 1/31-34). The section goes on to state that "[t]hese boards, however, have serious drawbacks for use in building construction," in that their high flammability precludes them from qualifying for use "in the more incombustible types of steel deck roof construction." (PX-2 at 1/36-44). After describing (and criticizing) attempts to develop more fire resistant foam (PX-2 at 1/44-52), the application notes urethane foam's "very poor resistance . . . to abrasion and other types of physical abuse" and its susceptibility to "thermal degradation and softening when exposed to even moderately elevated temperatures, such as those obtained at the surface of roof insulation board when the board is mopped with molten bitumen." (PX-2 at 1/52-59). McMillan's statement with regard to urethane board concludes as follows: "it will be readily seen why the use of urethane board is undesirable for roof insulation even in cases where the combustibility and the smoke generating properties of the urethane might be tolerated." (PX-2 at 1/59-63).

Mogg testified that the conclusory statement was accurate only with respect to urethane foam boards without felt facings on either side of the foam. (Tr. 654). Indeed, Mogg testified that facings such as roofing felt were placed on urethane foam "to protect the foam from physical abuse or the weather," thereby addressing the specific disadvantage attributed to urethane foam. (Tr. 85-86; *see also* Tr. 2648).[21] There is also evidence that the urethane foam boards with felt facings on both sides, made both by Apache and Barrett, were "a major factor in the market." (Tr. 2651). Finally, there is evidence that urethane foam board was "one of the four main roof insulation boards" in use prior to the Bolster application. (Tr. 63, 629, 655). It is thus readily apparent that the discussion of urethane foam in the Bolster patent was somewhat inaccurate with respect to the use of such boards in the roofing industry as well as their drawbacks. However, "under the totality of circumstances," *Monsanto, supra,* 456 F.2d at 600, *Frost, supra,* 540 F.2d at 611, the Court does not find that these inaccuracies were fraudulent. Attempts to address the problem of physical abuse were disclosed[22] as were the facts that rigid foam boards were widely used and that urethane foam was the *preferred* foam material of the building industry. The Court therefore does not believe that McMillan's description of the use and properties of urethane foam precluded the Examiner

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[21] The prior art section did state that "[t]hin protective skins of thermoset polyester resins containing, for instance, an adduct of hexahalocyclopentadiene, have been used to increase both the fire resistance and the physical strength of the [foamed urethane or other foamed plastic] cores." (PX-2 at 2/23-27). Although McMillan steadfastly denied that this information came from Robitschek Patent No. 3,158, 529 (DX-IP), (Tr. 1354-61), it is obvious that DX-IP was the source. *See e.g.,* DX-IP at 7/10-15. That patent is classified at Class 161-Subclass 161. Inasmuch as this class was searched by the Examiner in the prosecution of the Bolster patent (PX-1, Tr. 3138), the Court assumes the Examiner was aware of the Robitschek patent. *See* note 7 *supra.*

[22] These problems were known to those in the industry. *See* Stip. No. 57.

from "assessing the patent application against the prevailing statutory criteria."

With respect to perlite board, the patent application states that this is "another type of board much used in construction" (PX-2 at 1/63-64), praises its resistance to heat, reaction to molten bitumen, and performance on standard flame spread tests (PX-2 1/64-69), and notes the low insulating capacity of perlite board (PX-2 at 1/69-2/7). The discussion of perlite board concludes with the following statement:

> The excessive thickness of perlite board that its higher conductivity requires causes building design and construction problems which have generally resulted in the exclusion of perlite board from such applications. In other words, the use of conventional perlite board is generally limited to buildings in which a moderate amount of insulating value is required.

PX-2 at 2/7-14.

While it is true that perlite board was one of the four main roofing insulation materials in use at the time of the Bolster application (Tr. 63, 629, 655), the Court does not find that the discussion of perlite in the prior art section of the Bolster patent fraudulently misrepresents the facts. On the whole, the Court finds the discussion to be reasonably balanced, although perhaps moderately exaggerative with regard to the "limited" use of perlite board.

Kewanee's final contention with respect to Grefco's "misrepresentations" of the prior art concerns the JCP article. The prior art statement of the Bolster application discussed the use of "dense, incombustible materials" in combination with urethane foam. Those materials listed, taken from a variety of sources reviewed by McMillan (*e.g.*, DX-GA, DX-GC, DX-GD, DX-GE; *see* Tr. 1217-18), were "asbestos cement board, porcelained or enameled steel, aluminum, tempered glass." (PX-2 at 2/21-23). With regard to the findings of the JCP article, McMillan wrote,

> it is interesting to note that plastic foams are considered unsuitable for use in roof deck insulation when a steel deck is employed; *fiber board has been suggested as a barrier between the deck and the foam in such a case.* (PX-2 at 2/29-33) (emphasis added).[23]

McMillan testified that the information concerning the use of fiber board came from the JCP article (Tr. 1330-31), and that, although the JCP article is nowhere referenced in the application, he intended to disclose "the substance" of the article to the PTO. (Tr. 1338). However, McMillan also testified that his understanding of the statement in the JCP article that "plastic foams that offer no resistance under fire conditions would require one inch of fiber board or other barrier over the deck and under the foam in order to qualify" (DX-GA at 361) was that "whatever the problem was that prevented the use of plastic foams directly on steel decks would be solved." (Tr. 1336). In other words, while McMillan believed that the problem addressed by the Bolster patent — the inability of urethane foam to be used as roofing insulation over a steel deck — was "solved" by the JCP article, he told the PTO that the use of fiberboard was merely "suggested as a barrier . . . in such a case." Moreover, McMillan believed (erroneously) that the reference to expanded perlite in the footnote on page 361 of the JCP article referred to perlite board. (Tr. 1343). He never discussed with the inventors, however, what the term "or other barrier" referred to, despite this belief that perlite board was disclosed by the JCP article. (Tr. 133). While, as recently noted by Judge Wright, courts are "reluctant to find fraud in an attorney's failure to cite prior art references," *Her-*

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[23] The prior art section also referred to plywood/urethane and glass fiber board/urethane combinations. The "Disclosure of Invention" prepared in May, 1965 by Bolster, et al. contemplated the use of fiberglass as a possible facing for urethane foam. (PX-22). However, this idea was subsequently abandoned, most likely because of McMillan's belief that such a combination was already "known" or "anticipated" in the art. (DX-JP at 64, 67; see also Tr. 715, 1402, 1420).

cules v. *Exxon, supra,* slip op. at 65, the Court finds that McMillan's failure to direct the PTO's attention to the JCP article was fraudulent.

In *United States* v. *Standard Electric Time Co.,* 155 F.Supp. 949 (D. Mass 1957), Judge Wyzanski discussed the extent of the duty to disclose prior art:

> Of course, a putative inventor must disclose any printed publication which he either knows or believes describes the very invention claimed. United States v. American Bell Telephone Co., 128 U.S. 315, 355-356, 9 S.Ct. 90, 32 L.Ed. 450. More than this, if he knows of a printed publication which plainly describes his claimed invention, or comes so close thereto that every reasonable man would say the invention claimed was not original but had been anticipated, then regardless of his personal view that he is the original inventor, he will not be excused for his failure to disclose his knowledge.

155 F.Supp. at 952, *cited in Hercules* v. *Exxon, supra,* slip op. at 66.

The JCP article, it has been found herein, anticipates or, in the alternative, renders obvious the Bolster patent. See pages 14-17, 21-23 *supra.* Consequently, McMillan's failure to cite this publication or to disclose the importance of its findings in the patent application goes to the very heart of the Examiner's task of determining patentability under the applicable statutory criteria.[24] Thus, with respect to this allegation, the Court finds that all the elements of fraud have been proved by clear and convincing evidence. *Frost, supra; Monsanto, supra.*

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[24] This omission is especially material because the JCP article directly contradicts the statement at the conclusion of the examples that "it is equally evident that other materials which have been suggested in this type of application or which might be considered equivalent, *have failed to achieve satisfactory performance.*" (PX-2 at 7/8-9) (emphasis added). McMillan chose to rely solely upon the results of the gas-air burner flame test set forth in example 6 without disclosing to the Examiner the results of the JCP article that indicated that fiber board/urethane combinations would "qualify" on

C. *Examples*

1. *Introduction*

The Bolster application contained six examples which purported to report the results of various experiments and tests conducted on the claimed invention and materials suggested by the prior art. Examples 1-4 described the results of a "tunnel test" and "gas-air burner flame test" ("gas-air test") involving composites of perlite board and plastic foam. Example 5 compared the results of a perlite/foam composite with a fiberglass/foam composite on the gas-air test, and example 6 reported the failure of a fiber board/urethane composite on the gas-air test. The purpose of these examples was "to illustrate the invention and the improved properties thereof." (PX-2 at 4/39-40; Tr. 1245). Following the examples, it is stated:

> It stands therefore demonstrated by the results of the foregoing examples that perlite boards are peculiarly successful in composite structures with thermosetting and thermoplastic rigid organic foams. It is equally evident that other materials which have been suggested in this type of application or which might be considered equivalent, have failed to achieve satisfactory performance. (PX-2 at 7/3-9).

UL and FM construction tests. (Tr. 1350-53). In fact, it was the JCP article which most likely prompted Mogg and his co-inventors to run tests on fiber board/urethane composites so as to "check" the results disclosed in the JCP article in an effort to prove the superiority of perlite/urethane composites. (*See* page 36 *infra;* Tr. 667-68). Clearly, Grefco's theory of patentability at the time of the filing of the Bolster application was its superior performance in comparison to fiber board and fiberglass. *See* Tr. 1899-1903. It is clear then that the omission or misrepresentation of the JCP article was material. *See Frost, supra,* 540 F.2d at 610 (statement in affidavit that patent invention produced "markedly superior results to those obtained by utilization of any of the solvent materials disclosed in any of the reference patents" found to be "extremely troubling" in light of attorneys' knowledge that "there existed data casting some doubt on the accuracy of this statement.").

The Court finds that all six examples had the purpose of demonstrating the patentability over prior art of the invention claimed in the Bolster application. Although only examples 5 and 6 involved direct testing of perlite composites against fiber board and fiberglass composites, it is clear from a reading of the introductory and conclusory statements regarding the examples and from McMillan's testimony[25] that all six examples were designed to impress the Examiner with the superiority, and hence patentability, of perlite board composites over prior art substrates. *See also* PX-2 at 2/53-56.

2. *Misrepresentations of Test Results*

In example 1, it was reported that a 1" layer of polyurethane foam stabilized on a 1" perlite board "passed the tunnel test and successfully withstood a gas-air burner flame test for more than 10 minutes." (PX-2 at 5/2-4). In this example, these two tests were described, with the "tunnel test" referring to an Underwriters' Laboratories ("UL")[26] test (PX-2 at 5/6-31), and the gas-air test identified as a test "devised [by Grefco (Tr. 691)] to compare the flame resistance of various composite boards." (PX-2 at 5/32-33).[27]

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[25] McMillan testified that the paragraph quoted above was not considered by him to be part of the discussion regarding example 6, but was rather a summation of the results of all six examples. (Tr. 1297, 1452).

[26] Underwriter's Laboratories Inc. ("UL"), a non-profit, independent organization that conducts testing for public safety (Stip. No. 47), sets standards for proper roof deck construction and conducts tests on steel deck assemblies to determine whether the proposed assembly is safe in the event of a building fire. The specifications of those roof assemblies that pass the applicable roof deck tests are published at regular intervals (*e.g.* Construction No. 9 (DX-W)). (Stip. Nos. 49, 50).

[27] Kewanee implies that the gas-air test was devised so as to make perlite look good in comparison to fiber board and fiberglass and that the test was inappropriate for comparisons among building materials because substrates are not subject to direct flames on a roof. *See* Ma-

roni Dep. 41. Indeed, McMillan's "interest" in the gas-air test was due to his belief that it was a good predicter of performance in the UL tunnel test (Tr. 1422), but Mogg testified that there was no correlation between the two tests. (Tr. 692-95). This Court, however, has expressed "doubt" that the mere act of choosing promising experiments can, by itself, be either misleading or material." Hercules v. Exxon, *supra*, slip. op. at 82, 84; Corning Glass Works v. Anchor Hocking Glass Corp., 253 F.Supp. 461, 472 (D. Del. 1966).

Grefco's determination that "an assembly which resists the conditions of this test for a minimum period of *5 minutes* is considered acceptable (PX-2 at 5/44-46) is, though, extremely disturbing. An early draft of the application was silent with respect to passage of the gas-air test. (DX-JP at 114). In response to a letter from Mogg, McMillan inserted the reference to a five-minute period sometime after March 23, 1967. (DX-JP at 24, 114; PX-67). There is no documentation in the record concerning a five-minute minimum period of passage. McMillan's testimony was that "we somehow or other arrived at the five-minute level because obviously if it lasts long enough, everything will be destroyed." (Tr. 1519). The "decision" to adopt a five-minute passage period is especially curious in light of Tarbell's contemporaneous (November 22, 1966) statement that samples were tested on the gas-air test for *ten minutes* "as this is the time a material must withstand a flame to be approved by Underwriters' Laboratories when tested by their 'Tunnel Flame Spread Test.'" (DX-X). Further, William Maroni, manager of the materials section of Factory Mutual, whose duties include the "testing and qualification of building materials" (Maroni Dep. 48), testified that a five-minute test was insufficient to predict the performance of an insulation board on a roof. (Maroni Dep. 43). Were Grefco's choice and use of the gas-air test the only allegation of fraudulent conduct raised by Kewanee, the Court would be hard-pressed to find fraudulent intent and materiality in light of the disclosure in the application that a period of five minutes is considered acceptable. Presumably, the Examiner could have decided to request ten-minute tests of the samples if he doubted the validity of a five-minute test. However, since the 3/4" perlite board of example 3 lasted only seven minutes under the gas-air test and therefore would have failed a ten-minute test, the decision to deem five minutes "acceptable" impacts on the overall conclusion as to the results of the examples and on Grefco's theory of patentability. As such, the Court finds it to be an additional indicium of fraudulent intent by the inventors and their attorney.

Although the evidence presented by Grefco with respect to the testing of examples 1 through 4 was often inconsistent, confusing and incomplete, the Court finds that the composite referenced in example 1 was never tested in the UL tunnel test and therefore could not have "passed" such a test. (Tr. 1076-79). Instead, this sample was most likely tested on a so-called "modified bunsen burner test" which was referred to by Grefco at trial as a "simulated tunnel test." Tarbell testified that a sample as set forth in example 1 passed the modified test. (Tr. 941). Thus, example 1 is incorrect in its report that the sample "passed the tunnel test." Since the patent refers only to the tunnel test conducted by UL, as McMillan acknowledged, a reader of the patent could only assume that the sample passed the *UL* tunnel test. (Tr. 1445-46). Thus, example 1 describes the results of a test that was never run.

With respect to example 2, the Court finds that a sample of 1" "high density polyurethane" and 1" perlite board was successfully tested at UL. Mogg and McMillan both clearly so testified (Tr. 1163, 1433, 1439, 1449, 1479); Tarbell, however, testified that example 2 was not tested at UL, but rather passed the "simulated tunnel test." (Tr. 941, 1077). On this point, the Court credits the testimony of Mogg and McMillan over that of Tarbell and finds that example 2, a composite of 1" polyurethane and 1" perlite board, passed the UL tunnel test. (*See* PX-45 at 05501).[28] There is no evidence, however, that the density of the polyurethane portion of this composite had a density of "3.2 lbs. per cubic foot" as set forth in example 2. Documentation refers only to this sample as consisting of "higher density foam." (PX-37; *see* Tr. 992). The parties are agreed, however, that the sample of 1" foam and 1" perlite that passed the UL tunnel test in March, 1966 had a density of

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[28] It is interesting to note that Tarbell's testimony so totally confused Mogg and McMillan, both of whom sat through Tarbell's testimony, that, after hearing Tarbell, neither was certain as to what, if anything, in examples 1-4 had actually been tested at UL. (Tr. 1164, 1248, 1254).

3.95 lbs./cu.ft. (Doc. No. 192 at 39, 80), and it is clear to the Court, despite Tarbell's denial (Tr. 957), that the sample sent to UL is that referenced in DX-S containing a density of 3.95. [29] Therefore, given the credited testimony that example 2 was actually tested at UL, one can only conclude that example 2 incorrectly states the density of the foam as 3.2 lbs./cu.ft.

The efforts of the parties and the Court to ascertain the circumstances surrounding the inclusion of example 3 in the patent application produced perhaps the most mystery and drama of the trial. Upon review of the evidence, it now appears that a sample of "3/4" dry process perlite board, 1" low density polyurethane foam (2.0 lbs./cubic foot) and 5-mil Kraft paper," as set forth in example 3, was never tested at UL, although that example states that "[t]he resulting assembly . . . passed the tunnel test." (PX-2 at 20-26). *See* Tr. 231, 440-42, 446-47, 960-63, 1077-78, 1163. Grefco did, however, submit samples of 3/4" wet process perlite/urethane composites to UL for testing in April, 1967 and in August, 1967. Neither test result was disclosed to the PTO, either in the application or in subsequent discussions between Grefco patent counsel and the Examiner.

In the April, 1967 test, the Grefco sample received a "calculated flame spread value" of 50. (PX-71). As noted in the Bolster patent, a rating of 25 or under is considered acceptable. (PX-2 at 5/22-24). Grefco contends that this test was invalid because the perlite board was "kerfed" or slit so as to expose the urethane foam directly to heat, and that the inventors therefore properly withheld the test results from the Examiner. [30] The kerf was placed in the perlite board by Tarbell

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[29] The Court noted at the time that Tarbell's testimony with respect to the sample in example 2 was "virtually worthless" because of his poor recollection. (Tr. 959).

[30] Grefco also presented evidence that samples tested at UL were actually 11/16" perlite boards. (*See* Tr. 177). A stipulation entered into by the parties states, however, that the sample was 3/4" perlite (Stip. No. 80), and the plaintiff's Proposed Findings of Fact refer-

(Tr. 1108), who testified that he did so at the suggestion of Mr. Schmidgall, Technical Service Manager, Building Products Division, Grefco.[31] (Tr. 1019, 1108). However, it is clear that the purpose of the April, 1967 test was to see if 3/4" perlite board could be successfully combined with urethane foam. (Tr. 222-23, 533, 980, 1019-21, 1320, 1328; PX-63, 70). Tarbell's testimony that Grefco ran the UL test on the 3/4" perlite/urethane composite expecting it to fail because of the kerf defies logic and is highly unlikely (Tr. 979, 1108); the entire emphasis at Grefco at the time was to the contrary. Therefore, Grefco's conduct in running the UL test on kerfed 3/4" perlite board belies the inventors' protestations at trial that the kerf rendered the entire test invalid.

Grefco's attempts to excuse its failure to disclose the April, 1967 UL results by relying on doubts as to the test's validity

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ence 3/4", not 11/16" perlite. (*See* Doc. No. 176 ¶¶145-49, 151-53). Although at trial, counsel for Grefco acknowledged he was bound by the stipulation (Tr. 185), at oral argument he asked the Court to make a factual finding that the perlite board tested at UL in 1967 was 11/16" thick. (Doc. No. 192 at 84). Since the stipulation and Grefco's proposed findings (filed prior to trial) led Kewanee to believe that the samples were in fact 3/4" thick, the Court adheres to its ruling at trial that Grefco was bound by the stipulation. (Tr. 185). In any event, there was testimony by Mogg that he and his co-inventors were not disturbed that the board was 11/16" "because we felt that a data point in the tunnel test [at] 11/16th would be just as valuable to us as the data point at three-quarters of an inch and therefore, we didn't ask the plant to reship board that was within spec thickness. We went ahead with the 11/16th inch board." (Tr. 191; see also Tr. 544). Thus, any contention by Grefco that the inventors believed, in good faith, that the 1967 UL test results were invalid partly because the perlite board was not 3/4" thick is a mere afterthought.

[31] Tarbell's testimony with respect to the kerf is apparently confused. Funk testified that he fired Schmidgall in 1966. (Tr. 2094). Tarbell sent the 3/4" perlite composite to UL in March, 1967 (DX-AH). How he could have put the kerf in the composite at the suggestion of Schmidgall when Schmidgall was fired a year prior to that is unclear.

are further undermined by the fact that the August, 1967 test on a 3/4" perlite/urethane composite, conducted without a kerf, resulted in a flame spread value of 30. (PX-82). While the absence of a kerf in the August test may have reduced somewhat the flame spread value, unkerfed 3/4" perlite board still did not sufficiently protect the urethane foam.[32] Despite these adverse test results on 3/4" perlite composites, the patent application states unequivocally that such a composite "passed the tunnel test." (PX-2 at 6/25). Thus, the patent Examiner was told the combination of 3/4" perlite and urethane had passed the UL tunnel test when in fact it failed twice.

Based on the evidence, it is also apparent that example 4, which describes a sample of 2" commercial polyvinyl chloride foam slab [adhered to] a 1" dry process perlite board (PX-2 at 6/35-39), is incorrect in stating that the "composite board . . . was found acceptable" by the tunnel test. (PX-2 at 6/43-45). Such a sample was tested, if at all, only on the so-called "simulated tunnel test" and not on the UL test. (*See* Tr. 1078-79, 1165).

Thus, the Bolster application states that four examples passed the UL tunnel test, when McMillan and Mogg believed at the time that only example 2 did so, and when Tarbell be-

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[32] Grefco argues that this test was also invalid because 11/16" board was tested and because the test was incorrectly run for 11, and not 10, minutes. The Court has already addressed the 11/16" contention in note 30 *supra*. Mogg testified that even if the test had been run for 10 minutes, the flame spread value would have been 28.2 which, according to UL procedure, would have been rounded off to 30. (Tr. 199). Thus, even if the 3/4" perlite board were tested for 10 minutes without a kerf, it still would have failed the UL tunnel test. In fact, in November, 1967, Mogg stated that in "the UL tunnel tests to date on composite board . . . 3/4" or perlite failed." (PX-87 at 01939).

lieved that none of the examples had done so.[33] Moreover, the unsuccessful results of the April, 1967 and August, 1967 tests on 3/4" perlite board were not disclosed to the Examiner.

3. ***Analysis***

As mentioned at pages 28-29, *supra*, patent applicants are held to a high standard of conduct before the PTO due in part to the Office's inability to verify independently many of the representations made to it. This is particularly true when the representations pertain to the results of tests or experiments conducted by applicants. Since patent examiners are not equipped to perform their own tests and experiments, they must rely upon the candor and good faith of the applicants in reporting such results. (*See* Tr. 2951-52). *See Norton* v. *Curtiss*, 433 F.2d 779, 794 (C.C.P.A. 1970); *Hercules* v. *Exxon, supra*, slip op. at 64; *CPC International, Inc.* v. *Standard Brands Inc.*, 385 F.Supp. 1057, 1067 (D. Del. 1974); *Monsanto Co.* v. *Rohm and Haas Co.*, 312 F.Supp. 778, 793 (E.D. Pa. 1970), *aff'd*, 456 F.2d 592 (3d Cir.), *cert. denied*, 407 U.S. 934 (1972). This Court and the Third Circuit have therefore been particularly vigilant in requiring patent applicants to disclose *all* pertinent test results. *See e.g., Hercules* v. *Exxon, supra*, slip op. at 82; *Frost, supra*, 540 F.2d at 609-11; *Monsanto, supra*, 456 F.2d at 599-600.

In the instant case, Grefco failed to disclose the two unsuccessful UL tests on 3/4" perlite composites and misrepresented to the PTO that examples 1, 3 and 4 passed the UL tunnel test. At the same time, as previously found, Grefco did inform the PTO of the successful UL testing of example 2. Even assuming, without deciding, that the PTO's practice of permitting patent applicants to state test results in a patent application when in fact they are only *predicting* the results of

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[33] McMillan could not deny this allegation; he testified as follows: "I am saying [in the patent] that four examples passed the tunnel test when I only knew that one passed the UL tunnel test." (Tr. 1449-50).

tests that have not actually been conducted, so long as the applicants have based such predictions in good faith upon scientific foundation (Tr. 2946, 2949-54) is permissible,[34] Grefco's conduct before the PTO still renders the Bolster patent unenforceable. McMillan and the three inventors did not "merely" predict passage of unrun tests; they exercised selectivity in failing to disclose unsuccessful tests (the UL tests of April, 1967 and August, 1967), while disclosing the results of successful tests (example 2)[35] and misled the PTO with respect to the results set forth in example 3. No case has upheld such conduct against allegations of fraud. *See Frost, supra,* 540 F.2d at 609-10; *Monsanto, supra,* 456 F.2d at 599-600; Tr. 2949-50.[36]

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[34] The Court can conceive of no reason for the PTO to countenance such a practice. In effect, the PTO is permitting itself to be misled by patent applicants during the process of granting a monopoly. Moreover, the public is misled by such misrepresentations upon the publication of the patent. Nonetheless, this unexplained PTO procedure would preclude a finding of fraud in the Patent Office were it not for Grefco's omissions and misrepresentations as to the passing of certain tests. Whether and under what circumstances PTO-countenanced misrepresentations could lead to judicial invalidation of a patent is left to another day.

[35] The Court has already found that the failure to disclose the important findings of the JCP article was fraudulent, particularly in light of the disclosure in the patent application that fiber board failed to qualify for use as a substrate when tested by the gas air method in example 6. See pages 33-35 *supra.*

[36] Grefco argues that *Frost* and *Monsanto,* in which the Third Circuit Court of Appeals found fraud in the selective reporting of favorable test results, are "readily distinguishable" in that the applicants in those cases submitted data to the PTO showing the superiority of the claimed invention over the prior art. As found herein, however, *see* page 36 *supra,* the purpose of all six examples of the Bolster patent was to demonstrate the superiority of perlite over the prior art solutions of fiberglass and fiber board. Inasmuch as the omissions and misrepresentations pertaining to the test results were material to this contention, *see* pages 44-45 *infra, Frost* and *Monsanto* are highly pertinent, if not controlling, cases.

While the co-inventors' good faith belief excuses their failure to disclose that examples 1 and 4 had not been tested on the UL tunnel test for purposes of a finding of fraudulent conduct, the Court finds that the inventors' "doubts" as to the validity of the UL tests on 3/4" perlite composites do not excuse their failure to apprise the Examiner of the results of these tests.[37] The doubts relating to the fact that 11/16" board may have been tested has been found to be an afterthought, *see* note 30 *supra*, the contention that the 11 minute test affected the test results has been discounted, note 31 *supra*, and the concerns expressed at trial about the effect of the kerf in the April test are not persuasive in light of the conduct of Grefco in running the test (with the kerf) to see whether 3/4" perlite was in fact operable, *see* page 40 *supra*. Second, and most important, any doubts the inventors had about the validity of the tests of 3/4" perlite board composites should have been disclosed to the Examiner for *his* determination. *See Frost, supra*, 540 F.2d at 609-10; *Standard Oil* v. *Montedison, S.p.A., supra*, slip op. at 169. Instead, Grefco chose to usurp the function of the Examiner when it withheld test results because they were, *in its view*, "inconclusive" (Tr. 804) or invalid. Grefco's argument to this Court that the April, 1967 and August, 1967 tests support, rather than harm, its theory of patentability would have been better presented to the Examiner, along with disclosure of the results.

The Court finds that the omission and misrepresentation of test results were material to the Examiner's consideration of the Bolster application. While it is true that examples 1-4 did not directly compare the performance of perlite with fiber board or fiberglass as a substrate for use with urethane, and that the prior art solutions were not tested, according to the

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[37] There is no question that a 1" perlite/urethane composite had actually passed the UL tunnel test by the time of the patent application. (PX-45). *See* page 38 *supra*. With respect to example 3, however, despite the passage of 3/4" perlite on the "simulated tunnel test" (Tr. 942), Grefco's prediction of passage on the UL tunnel test cannot be condoned in light of the two failures when actually tested on the UL test.

patent,[38] by the tunnel test method, these examples still were an integral part of Grefco's overall theory of patentability that its invention worked and protected urethane foam from fire while the prior art "equivalents" did not. The patent itself states, "[i]t stands therefore demonstrated *by the results of the foregoing examples* that perlite boards are peculiarly successful in composite structures with thermosetting and thermoplastic rigid organic foams." (PX-2 at 7/3-6) (emphasis added).[39] Clearly, a purpose of examples 1-4 was to demonstrate that perlite board of 3/4" and 1" thickness successfully protected urethane.[40]

There is no question that the UL tunnel test had great significance in the roofing industry at the time of the Bolster application. *See* Tr. 66, 638. In fact, the patent itself indicated that the passage of "a new type of urethane foam" on the ASTM E 84 tunnel test made it "suitable for some of the more incombustible types of construction." (PX-2 at 1/44-49). The Examiner might justifiably have placed greater weight upon the information in the patent that the perlite samples passed the *UL* tunnel test than he would had he known that the passage was actually on a "simulated test." Similarly, it cannot be said that the disclosures of the unsuccessful results of the UL test run on the 3/4" boards would have been unimportant to the Examiner. Moreover, had the Examiner been advised that "*one inch* of fiber board or other barrier" (DX-GA) qualified on industry construction tests and that 3/4" perlite board did not, he might seriously have questioned whether the Bolster patent should be granted with the .6" and 3/4" limits of claims 1 and 7, respectively, and, if not, whether a 1" perlite board composite was really new in

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[38] Tarbell testified that he ran "simulated tunnel tests" on fiber board and fiberglass, but did not recall the results. (Tr. 902, 999).

[39] See note 25 *supra*.

[40] If examples 1-4 were really as immaterial to patentability as now urged by Grefco, there presumably would have been no reason for their inclusion in the application.

light of the JCP disclosures. Thus, the nondisclosure of the results of the two UL tests on 3/4" board and the misrepresentation of the passage of example 3 prevented the Examiner from fairly assessing the Bolster application against the applicable statutory criteria of utility, anticipation and obviousness.

The Court has no difficulty in finding that Kewanee has met its burden of proving that Grefco's conduct in its reporting of test results to the PTO was the product of "an affirmative intent to deceive or at least a gross negligence or recklessness in misrepresenting the truth." *DeLong, supra,* slip op. at 20. Tarbell witnessed the April, 1967 test at UL (Tr. 938); there can be no doubt that he was aware of the results prior to the filing of the application. Mogg was also aware, prior to May 15, 1967, of the fact that the 3/4" board received a flame spread value of 50 on the UL tunnel test. (PX-72, 492, 502). McMillan testified, however, that he was not aware of the UL test results on 3/4" perlite board until this litigation. (Tr. 1255, 1457-58). Mogg never told McMillan the results of this test (Tr. 162), and the Court finds, notwithstanding Tarbell's testimony (Tr. 963-64, 972-78), that Tarbell did not inform McMillan that 3/4" perlite board had failed the UL tunnel test.[41] There is evidence that McMillan considered the UL re-

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[41] McMillan testified that if anyone had told him the results, it would have been Tarbell. McMillan's testimony that he never received the results of the test at UL is credible in light of PX-59. In this document, Mogg wrote to Carl Peters, Head of the Patent Department at GLC, on January 5, 1967, that he was removing McMillan from "our distribution list for future reports and further information concerning our research activities and results will be supplied to you only on a need-to-know basis." The inference to be drawn from this is that either Mogg or his co-inventors determined that Peters or McMillan did not have a "need-to-know" the April, 1967 test results.

McMillan also does not recall being informed by the inventors that they were dissatisfied with the procedures employed at UL or that the testing done at UL was defective. (Tr. 1314-15; *see also* 494-95).

sults to be important with respect to the patent application; sometime after January, 1967 he wrote a note to himself to "get composite board rating as soon as available." (DX-GB; Tr. 1309-14, 1496-97). McMillan knew that UL tests were planned (Tr. 1307-08, 1497), and told Tarbell of his desire for the UL rating (Tr. 1312), yet Tarbell never provided it to him. Moreover, McMillan apparently never sought to obtain the results of the test immediately prior to writing and submitting example 3, which states that a 3/4" perlite board composite "passed the tunnel test." McMillan testified that had Tarbell reported a "rating of failure," he would have had to "look at the rating and decide whether there was some valid invention left or not" (Tr. 1328) and might have "closed the whole case." (Tr. 1320).[42]

McMillan was also never informed of the results of the August, 1967 test on 3/4" perlite composite (Tr. 1255, 1457-58). Mogg and Tarbell, however, were informed of the results shortly after the test was performed. (*See* PX-87; Tr. 939). Despite this knowledge, the test results were not disclosed to the PTO. Grefco does not contend that simply because the test results were learned after the filing of the patent application, they need not be disclosed. Such a rule of law would be contrary to the requirement of high standards of conduct in proceedings before the PTO. In *Precision Instrument Manufacturing Co.* v. *Automotive Maintenance Machinery Co.*, 324 U.S. 806, 818 (1945), the Court stated:

> Those who have applications pending with the Patent Office or who are parties to Patent Office proceedings have

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This testimony tends to undermine Grefco's contentions that the inventors felt that the UL tests were invalid and that their "good faith belief" excused their failure to disclose the test results. Mogg knew he had a duty to bring even unfavorable test results to the attention of Mr. McMillan (Tr. 492-93), but did not.

[42] McMillan also testified, under questioning from the Court, that had he known that 3/4" perlite board failed the UL tunnel test he "would not have said 'passed the tunnel test'" in example 3. (Tr. 1458).

an uncompromising duty to report to it all facts concerning possible fraud or inequitableness underlying the applications in issue.

It is immaterial whether the failure to disclose the UL test results of April, 1967 and August, 1967 was due to an affirmative intent to deceive the PTO or to gross negligence on the part of McMillan and the inventors. Consideration of all the evidence presented on this issue, including the materiality of the omissions and representations, *see Hercules* v. *Exxon, supra,* slip op. at 77, the failure of the inventors to inform McMillan of the results while knowing of his interest in them and McMillan's failure to secure the results given his belief that the UL results were important, leads to the conclusion that Kewanee has proved, clearly and convincingly, that Grefco's conduct before the PTO in this regard was fraudulent.[43]

IV. CONCLUSION

For all the reasons set forth herein, the Court finds that the Bolster patent is invalid under 35 U.S.C. §§102, 103 and is invalid and unenforceable because of Grefco's fraudulent conduct in the procurement of the patent. The Court further finds

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[43] Kewanee also alleges that Grefco's failure to disclose that a sample of 1/2" perlite board/urethane failed the UL tunnel test was fraudulent. (*See* PX-14 at 05481). There is no question McMillan knew about this test and deliberately omitted it from the patent. (Tr. 1302, 1428). While the Examiner probably could not have approved the Bolster patent with a lower limit of .6" thick had he known that 1/2" and 3/4" thickness had both failed the UL tunnel test, the Court does not believe that the information that 1/2" perlite board was unsuccessful would have added anything to the Examiner's deliberations with respect to patentability if he had known 3/4" thickness failed. *See* Norton Co. v. Carborundum Co., 530 F.2d 435, 444 (1st Cir. 1976) ("[t]he scope of a patent defines not only its enforceability but also the limits of materiality of an allegation of fraud in the procurement of the patent."); Corning Glass Works v. Anchor Hocking Glass Corp., 253 F.Supp. 461, 474-75 (D. Del. 1966), *mod'd,* 374 F.2d 473 (3d Cir.), *cert. denied,* 389 U.S. 826 (1967).

that Grefco's conduct before the Patent Office makes this an "exceptional case" under 35 U.S.C. § 285 and therefore, attorney's fees will be awarded to Kewanee. *See Watts* v. *University of Delaware,* 471 F.Supp. 1272, 1285 (D. Del. 1979), *rev'd on other grounds,* No. 79-1997 (3d Cir. May 1, 1980); *W. L. Gore & Associates, Inc.* v. *Oak Materials Group, Inc.,* 424 F.Supp. 700, 704-05 (D. Del. 1976); *Chromalloy American Corp.* v. *Alloy Surfaces Co., Inc.,* 353 F.Supp. 429, 431 (D. Del. 1973); *Mueller Brass Co.* v. *Reading Industries, Inc.,* 352 F.Supp. 1357, 1380 (E.D. Pa. 1972), *aff'd mem.,* 487 F.2d 1395 (3d Cir. 1973). If the litigants cannot agree as to the appropriate amount of attorney's fees, upon receipt of advice to that effect, a hearing will be scheduled for disposition of the attorney's fees issue.

The parties shall submit an appropriate form of order granting judgment for the defendant on notice within 20 days.[44]

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[44] Although the resolution herein renders unnecessary a determination with respect to Kewanee's remaining allegations of invalidity — defective oath, laches and estoppel, the Court finds that Kewanee has failed to prove all the essential elements of each of these defenses. *See* Tr. 1393, 1499-1500, 1260-82 (defective oath allegation); Jenn-Air Corp. v. Penn Ventilator Co., Inc., 464 F.2d 48 (3d Cir. 1972); Johnson & Johnson v. W. L. Gore & Associates, Inc., 436 F.Supp. 704, 733-34 (D. Del. 1977); Minnesota Mining & Mfg. Co. v. Berwick Industries, Inc., 373 F.Supp. 851, 862 (M.D. Pa. 1974), *aff'd,* 532 F.2d 830 (3d Cir. 1976); Tr. 2218-25, 2250-58, 2286-2300, 2311-17 (failure to prove prejudice to Kewanee as a result of Grefco's delay in filing infringement suit); *Id.* (failure to prove detrimental reliance by Kewanee upon action by Grefco in not enforcing patent).

UNITED STATES PATENT OFFICE
3,510,391

PERLITE BOARD BONDED TO ORGANIC PLASTIC FOAM

Lyle R. Bolster, La Canada, Harland E. Tarbell, Torrance, and Donald W. Mogg, Redondo Beach, Calif., assignors to Grefco, Inc., Philadelphia, Pa., a corporation of Delaware

No Drawing. Filed May 15, 1967, Ser. No. 638,629
Int. Cl. B32b *3/26, 5/18*
U.S. Cl. 161—160 10 Claims

ABSTRACT OF THE DISCLOSURE

A composite thermal insulation board having a U value of 0.2 or less and combining good mechanical properties with excellent flame resistance, has been made by covering at least one surface of a rigid, organic plastic foam layer having a thermal conductivity (K factor) of 0.4 or less and a thickness preferably within the range of 1/2 to 2 inches, with a perlite board having the following characteristics: K factor, 0.4 or less; thickness, preferably 3/4 to 1 inch; perlite content, preferably 50 to 90% by weight; and organic phase content, preferably not more than 30% by weight. The other surface of the organic foam may be covered by any conventional facing as well as by perlite board, or it may remain uncovered.

THE PRIOR ART

Rigid plastic foam boards are unusually good thermal insulators and have thus found wide and varied use in industry. Urethane foam board, in particular, exhibits unusually low thermal conductivity and is for that reason the preferred plastic foam material of the building industry. It has a very low K factor, the K factor being the conventional coefficient of thermal conductivity expressed in B.t.u. inch/hour.square foot.°F. These boards, however, have serious drawbacks for use in building construction. For instance, all ordinary grades of urethane foam board and practically all self-extinguishing grades are unable to exhibit sufficiently low flammability in standard fire tests to qualify for use in the more incombustible types of steel deck roof construction, such as Underwriters' Laboratories construction Nos. 1 and 2 and Factory Mutual

Class 1 construction. A new type of urethane foam has recently been placed on the market which has sufficiently low flame spread rating in the ASTM E84 tunnel fire test so that from a flame spread point of view it is suitable for some of the more incombustible types of construction. This expensive product, with which the present invention is not concerned, has the disadvantage of giving off large amounts of smoke when exposed to fire, as in the tunnel test. Furthermore, urethane board undergoes significant thermal degradation and softening when exposed to even moderately elevated temperatures, such as those obtained at the surface of roof insulation board when the board is mopped with molten bitumen. If one also considers the very poor resistance of urethane board to abrasion and other types of physical abuse, it will be readily seen why the use of urethane board is undesirable for roof insulation even in cases where the combustibility and the smoke generating properties of the urethane might be tolerated.

Perlite insulation board constitutes another type of board much used in construction. Perlite board resists heat well, passes the standard flame spread tests and behaves better than urethane board when mopped with molten bitumen, especially if it has been given a surface coating or a surface treatment such as the Sealskin© treatment. However, its heat conductivity or K factor is approximately three times as high as that of properly manufactured urethane board. For application requiring unusually good roof and wall insulation, total perlite board thickness of at least three or four inches would be necessary to attain satisfactorily low conductance. This conductance or U value, as it is known in the trade, is roughly speaking the conductivity of the whole insulating assembly expressed in B.t.u.hour.°F.ft.^{2}. The excessive thickness of perlite board that its higher conductivity requires causes building design and construction problems which have generally resulted in the exclusion of perlite board from such applications. In other words, the use of conventional perlite board is generally limited to buildings in which a moderate amount of insulating value is required.

The excellent insulative properties of urethane foam have of course encouraged the development of several approaches to the combustibility and susceptibility to physical damage problems that have just been pointed out. Sandwich constructions, for instance, are commonly produced having a foamed urethane or other foamed plastic core between dense, incombustible materials such as asbestos cement board, porcelained or enameled steel, aluminum, tempered glass and so on. Thin protective skins of thermoset polyester resins containing, for instance, an adduct of a hexahalocyclopentadiene, have been used to increase both the fire resistance and the physical strength of the cores. Even combustible materials such as plywood have been used to encase urethane and other organic foams. In this respect, it is interesting to note that plastic foams are considered unsuitable for use in roof deck insulation when a steel deck is employed; fiberboard has been suggested as a barrier between the deck and the foam in such a case. The last type of sandwich that shall be mentioned is that made of urethane foam and glass fiber board, a low density inorganic insulating structure.

OBJECTS

It is an object of this invention to provide an insulating structure whch overcomes the mechanical and physical disadvantages of plastic foam boards. Another object is to provide a combustion resistant structure based on urethane foam. Still another object is to provide an insulating structure of sufficiently low heat conductance so that it can find application in conventional roof building systems, even when an unusually low U value is required.

SUMMARY OF THE INVENTION

These and other objects which shall become evident upon description of this invention, have been accomplished by producing an insulation board in the form of a sandwich with a foamed plastic core, and with one or both of the outer layers of the sandwich consisting of nonplastic perlite insulation board. It has been found that particularly desirable boards can

be made with foamed-in-place urethane as the core and Permalite© or other perlite board for one or both of the outer layers. The new sandwich construction not only overcomes the physical and chemical disadvantage of organic plastic foam boards, especially those of urethane foam, but does so while achieving low conductance or U values with much less thickness than perlite board would require, thus rendering the sandwich product usable in applications where the use of neither component is presently desirable.

The sandwich or composite board of this invention has a thermal conductance or U value equal to or smaller than about 0.2. At least one of the surfaces of its foam element is covered with a perlite board having a minimum thickness of 0.6 inch and a conductivity or K factor of less than 0.45. The other foam surface may be covered with any other protective or insulative material or it may remain uncovered, depending on the application requirements.

In the case of urethane foam-perlite board composite structure, it has been found preferable, especially for roof deck application, that the composite insulating structure consist of a perlite board layer about 3/4 to 1 inch thick and a rigid foam layer 1/2 to 2 inches thick. Greater thickness of both materials may be employed of course when excessive thickness does not cause structural problems. In such cases, the benefits conferred by the combination disclosed here certainly remain available.

The perlite board that can be used to produce the insulating structures of this invention is a rigid composition substantially made from expanded perlite mineral, fibers, binders and water-proofing agents, used in proportions that are well known in the art. These components can be mixed by a wet process, as already disclosed in several patents such as U.S. 2,634,207, 3,042,578 and others, or by a dry process, as described in application S.N. 557,857, filed on May 26, 1966 and now U.S. Patent 3,344,217. Some additional positive requirements of usable perlite board other than the physical limita-

tions already specified, i.e., a K factor of less than 0.45 and a thickness of at least 0.6 inch, are a minimum perlite content of at least 30% and a combustible organic phase of not more than about 35% by weight, said organic phase usually comprising cellulosic fibers and compusible sizing such as asphalt. The preferred expanded perlite content of the board has been found to be within the range of about 50 to 90% by weight. All other necessary characteristics of usable perlite boards have been described in the art.

The rigid plastic foam component of the composite board of this invention can consist of any thermosetting or thermoplastic foamed synthetic material having a thermal conductivity or not more than 0.4. This includes the preferred and most commonly used materials such as polyurethane and polystyrene foams, as well as other known organic foams having the proper conductivity limits, such as epoxy and poly-(vinyl chloride) foams. These materials as well as many processes for their preparation are well known to those skilled in the art as evidenced by the article on "Foamed Plastics" in the second edition (1966) of Kirk-Othmer's Encyclopedia of Chemical Technology (volume 9, pages 847-884) and in the Handbook of Foamed Plastics edited by Rene J. Bender and published by Lake Publishing Corporation, Libertyville, Ill. (1965). A few specific foam preparations are provided in the examples to illustrate this art. Beyond this, suffice it to say that foamed plastics are formed most often by heating expandable formulations which contain a blowing agent, i.e., a liquid or solid which upon heating is capable of forming a gas either chemically or physically. Among these agents are pentanes, hexanes, halocarbons, azodicarbonamide, dinitrosopentamethylene tetramines and so on. These agents are generally added to the plastic composition before foaming but in some cases, as with polystyrene, they may be incorporated in the plastic during polymerization. Polystyrene and Polyvinyl chloride foams are produced by a physical stabilization process while polyurethane and epoxy resins, which must undergo chemical crosslinking reactions as they assume their final shape, are said to undergo a chemical stabilization process.

The manufacture of polyurethane foams, or urethane foams for short, is based principaliy on the urethane reaction and the urea reaction. In the former, a hydroxyl group adds onto an isocyanate group to form a urethane bond. The heat liberated in the process is used to expand the blowing agent and thus cause the plastic mass to foam. The urea reaction, on the other hand, involves the condensation of the isocyanate group with water to liberate carbon dioxide and yield a primary amine. This amine then adds onto another isocyanate group to form a substituted urea. This reaction occurs of course when water is present in the formulation and, in such a case, it competes with the urethane reaction. Obviously, the isocyanates and alcohols employed must be at least difunctional in order to obtain polymers and a certain amount of higher functionality is needed to achieve crosslinking and the desired degree of rigidity. The ingredients may be mixed all at once or some prepolymerization may be done before the foaming process is undertaken.

As to ingredients, the usable list includes polyols, hydroxyl-terminated polyesters, polyether polyols, hydroxyamines, diisocyanates, polymeric isocyanates, catalysts, surface active agents and blowing agents. Preferred substances from these classes are: polyols having an equivalent weight of 80 to 180 and a functionality of six or higher; hydroxyl terminated polyesters having an equivalent weight of about 125 and a hydroxyl number of about 500; propylene oxide adducts of polyols such as sorbitol; amine-based polyols such as N,N,N',N'-tetrakis (2-hydroxypropyl)ethylenediamine; toluene diisocyanates; polyarylpolyisocyanates such as polymethylenepolyphenylisocynate; tertiary amine catalysts, e.g., triethylamine; surfactant copolymers based on dimethyl polysiloxane and polyoxysiloxanes; and halocarbon blowing agents, especially fluorocarbons. Some flame resistance may be imparted to the foams by using phosphorus or chlorine substituted polyols. Finally, various additives may be incorported for a number of reasons. Included in this category are dyes, fibers and fillers such as woodflour, clay, talc, antimony oxide, ammonium phosphate and so on.

The polyurethane foam can be formed and stabilized in situ on the perlite board; in this case, it serves as its own adhesive and no other bonding substance is needed. Alternately, as is the case with other usable plastic foams, ready made board of polyurethane foam can be employed, necessitating recourse to an extraneous adhesive to bond the foam board to the perlite board and to the other facing material that may be used. Any conventional adhesive suitable for the surfaces involved can be used for this purpose, asphalt emulsions and phenolaldehyde adhesives such as phenol-resorcinol-formaldehyde being typical of such well known materials.

The following examples will serve to illustrate the invention and the improved properties thereof. They are not to be construed as limitations other than those set by the appended claims. All parts and percentages used in said examples are on a weight basis unless otherwise noted.

EXAMPLE 1

A composite board was formed by foaming and stabilizing a 1" layer of polyurethane on a 1" perlite board.

The perlite board consisted of 70 parts perlite, 24 parts pulped newsprint, 5 parts asphalt and 1 part Wyoming bentonite. The organic content was thus 29%. The board was made by a wet process, as taught in U.S. Pat. 2,634,207, which substantially involves preparing a slurry of perlite, fiber, water and asphalt emulsion, forming the mixture into a sheet or web, and drying it.

The polyurethane foam was formed according to a Jefferson Chemical Company recipe by mixing foam component A with foam component B in a Martin-Sweets foaming unit to give a polyurethane layer having a density of 2 lbs. per cubic foot and a K factor of 0.12. Component A consisted of 100 parts of a propylene oxide adduct of sorbitol having a hydroxyl number of about 490 and a 75°F. viscosity of about 10,000 centipoises, which is available commercially as Thanol© RS-700 (Jefferson Chemical Company, Inc.). Component B was a mixture of

the following ingredients: 56 parts Thanol© RS-500 (Jefferson Chemical Company, Inc.), another propylene oxide adduct of sorbitol having a 75°F. viscosity of about 50,000 cps. and a hydroxyl number of about 640; 33.5 parts Freon-11© (du Pont), CCl_3F; 0.68 part triethylenediamine (Houdry Process and Chemical Company); 28 parts Firemaster© T23P (Michigan Chemical Corporation), 2,3-(di-bromopropyl) phosphate; and 0.9 part L-520 Silicone Oil, a copolymer of dimethylpolysiloxane and polyoxysiloxane with ethylene and propylene oxide (Union Carbide Corporation).

The resulting urethane-perlite board composite had a conductance or U value of 0.09. It passed the tunnel test and successfully withstood a gas-air burner flame test for more than 10 minutes. The tests shall now be described.

The tunnel test is a common name for the standard method of test for Surface Burning Characteristics of Building Materials. It can be found in A.S.T.M. Standards 1964, part 14, page 331, under the designation E84-61. The test measures surface flame spread. It makes use of a tunnel furnace developed by the Underwriters' Laboratories, which consists of a 25-foot-long tunnel having an inside width of 17-1/2" and an inside depth of 12" measured from the bottom of the tunnel to the bottom surface of the specimen. The specimen measuring 20" x 25' constitutes the roof of the tunnel. The apparatus is fired from one end by gas burners and a flame is encouraged by controlled draft to spread along the underside of the specimen. The time rate of flame travel determines the "flame spread rating." Red oak flooring is rated as 100 and cement-asbestos board at 0. All other materials are rated by comparison. A specimen is considered by fire protection authorities to pass this test when it obtains a rating of 25 or under on this scale.

The 25-foot specimen is usually made up of several shorter lengths of the material being tested. In the present tests, it was made up of boards 20" wide and approximately 4 feet long. The composite boards were placed perlite board face down,

and were simply butted against each other. Nothing was done to cover or protect the joints.

The gas-air burner flame test devised to compare the flame resistance of various composite boards is relatively easy to carry out but it subjects the boards to far more drastic conditions than those attending the tunnel test. It is done as follows: A 12" x 12" piece of composite board is placed on a ringstand, perlite board face down, and the vertex of the flame of a Benz-O-Matic propane torch, or Fisher Blast gas-air burner 3-910-5, is centered 1/2" below the insulation board. The air and gas feeds are adjusted to yield maximum heat output. This subjects the test surface to a very hot blue flame. The time is recorded from the moment the flame is positioned until the plastic foam is degraded by the heat or until a 10-minute period has passed. An assembly which resists the conditions of this test for a minimum period of 5 minutes is considered acceptable.

The thermal conductance of the composite boards of this invention is calculated, as mentioned earlier, from the conductivity of the component boards as determined by the Guarded Hot Plate test C-177-63, A.S.T.M. Standards 1964, part 14, page 15. Briefly, the technique consists in measuring the electrical energy required to maintain a central "hot plate" at a selected temperature. Test specimens cover each of the two hot-plate surfaces and in turn are covered by "cold" plates which are maintained at a prescribed temperature. A guard ring around the four edges of the hot plate is controlled at hot plate temperature to prevent edge heat loss. All heat energy is thus transmitted from hot plate to cold plate through the specimens. The amount of heat transmitted is determined by the insulating effectiveness of the specimens and is measured by recording power input to the hot plate heaters. A low K factor indicates superior insulating ability. It is calculated by the formula: $K = qx/A\ T$, wherein K is in B.t.u. in./hr.°F. ft.^{2}; q is B.t.u./hr.; x is specimen thickness in inches; A is specimen area in square feet, and **D** is temperature drop through specimen in °F.

EXAMPLE 2

A composite board for roofing application was formed by foaming and stabilizing a 1" layer of high density polyurethane on a 1" perlite board. The polyurethane surface was covered by 15-lb. roofing felt while still adhesive. The polyurethane layer had a density of 3.2 lbs. per cubit foot and a K factor of 0.17. The resulting composite board had a U value of 0.12, and was found acceptable by both the tunnel test and the gas-air flame test.

The perlite board used here was that of Example 1. The polyurethane foam, on the other hand, was prepared substantially in the manner of Example 1 but with the following ingredients. Component A consisted of 120 parts of a polymeric isocyanate, PAPI, which stands for polymethylenepolyphenyl isocyanate. Component B consisted of: 100 parts of Polyol 358, a Wyandotte Chemicals Corporation product containing significant amount of combined phosphorus for enhanced fire resistance; 1.43 parts tetramethylbutanediamine; 2.0 parts silicone oil DC-113 (Dow-Corning Corporation), which unlike the L-520 does not contain Si-O-C linkages; and refrigerant 113 (CCl_2F-$CClF_2$). Both the diamine and the refrigerant are Union Carbide Corporation products.

EXAMPLE 3

A composite board fashioned essentially in the manner of Example 1 from 3/4" dry process perlite board, 1" low density polyurethane foam (2.0 lbs./cubic foot) and 5-mil Kraft paper. The foam had a K value of 0.115 and the perlite board, 0.38.

The resulting assembly had a U value of 0.095. It passed the tunnel test, although slight swelling of the foam was observed after the minimum 10 minutes exposure required, and it lasted 7 minutes in the gas-air flame test before significant deterioration took place.

The dry process perlite board contained 47 parts perlite, 20 parts newsprint fiber, 7 parts asphalt and 26 parts Wyoming bentonite. These ingredients, slightly moistened, were mixed

by air turbulence, formed into a board and dried, as taught in S.N. 557,857, filed May 26, 1966.

EXAMPLE 4

A composite board was made by bonding together 2" commercial polyvinyl chloride foam slab and a 1" dry process perlite board with a phenol-resorcinol-formaldehyde adhesive, Koppers Tar and Chemical Company Penacolite® 4422. The K factor of the foam was 0.20 while that of the perlite board was 0.40.

The composite board had a U value of 0.08 and was found acceptable, as tested by the tunnel and the gas-air flame methods.

The dry process perlite board contained 47 parts perlite, 26 parts newsprint fiber, 1 part waterproofing silicone (Dow-Corning's 772) and 26 parts Wyoming bentonite. These ingredients, slightly moistened, were mixed by air turbulence, formed into a board and dried in the manner of Example 3.

EXAMPLE 5

A composite board was made with 1" Styrofoam® polystyrene foam (Dow Chemical Company) and 1" dry process perlite board bonded with an asphalt emulsion adhesive. The polystyrene component had a K value of 0.26 and the perlite board, 0.38. The perlite board was that used in Example 3.

Another composite board was made in the same manner, except that the perlite board was replaced by a 1" glass fiber roof insulation board.

On testing these two composite boards by the gas-air flame method, it was observed that the glass fiber-polystyrene structure was completely burned through (insulation and foam) in 1 minute and 58 seconds while the perlite board assembly successfully resisted the test conditions. After 10 minutes while the perlite board was charred on the botton as usual, only 1/4" of the foam had melted.

EXAMPLE 6

A composite board made of a 1" layer of fiberboard, i.e., a commercially available cellulosic fiber material product, and a 1" low density polyurethane foam board did not withstand successfully the gas-air flame test. The fiberboard burst into flame immediately upon exposure and was burnt through in less than 3 minutes, thus affording little protection to the organic foam board.

It stands therefore demonstrated by the results of the foregoing examples that perlite boards are peculiarly successful in composite structures with thermosetting and thermoplastic rigid organic foams. It is equally evident that other materials which have been suggested in this type of application or which might be considered equivalent, have failed to achieve satisfactory performance.

Although this invention has been illustrated by giving specific details of certain species embraced within its scope, it is understood that various modifications within its spirit and scope are possible that will also produce composite structures of controlled dimensions which require no further fabricating after the foaming process and which possess superior flame resistance, minimum bulk and maximum insulative capacity.

What is claimed is:

1. A composite board having a U value of not more than 0.2, which comprises

(a) a rigid organic plastic foam layer having a K factor not greater than about 0.4, covered on at least one of its surfaces by

(b) a perlite board having a minimum thickness of 0.6 inch, a K factor not greater than 0.45, a minimum perlite content of at least about 30% by weight and a combustible fiber and sizing content of not more than about 35% by weight, said layer being adhered to said board.

2. The board of claim **1** wherein the other surface of the foam layer is covered by a material selected from the group consisting of perlite board, roofing felt and paper.

3. The board of claim **1** wherein the rigid foam material is selected from the thermosetting and thermoplastic materials within the class consisting of polyvinyl chloride, polyurethane, polystyrene and epoxy resins.

4. The board of claim **1** wherein the rigid foam layer has a thickness within the range of 1/2 to 2 inches.

5. The board of claim **1** wherein the perlite board has a perlite content of 50 to 90% by weight.

6. The board of claim **5** wherein the thickness of the perlite board is within the range of 3/4 to 1 inch.

7. A composite structure in the form of a sandwich consisting of

(a) a 3/4 to 1 inch thick base layer of perlite board having a perlite content of about 50 to 90% by weight and a combustible fiber and sizing content of not more than about 30% by weight:

(b) a rigid polyurethane foam layer of 1/2 to 2 inches having a density of about 1.5 to 3.5 pounds per cubic foot, and

(c) a top layer selected from the class consisting of perlite board, roofing felt and paper, said base layer and said board layer being adhered to said foam layer.

8. The composite structure of claim **7** wherein the combustible fiber and sizing phase of the base layer perlite board consists of shredded newsprint and asphalt.

9. The composite structure of claim **7** wherein base layer perlite board contains clay.

10. The composite structure of claim **7** wherein the rigid foam layer is foamed in place.

No references cited.

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U.S. Cl. X.R.

161—161, 165, 403

Cellular Plastics in Construction Applications and Fire Protection

Prepared by a Task Force of the Flammability Committee, SPI Cellular Plastics Division, Melvin Kaplan, Task Force Chairman (National Aniline Div., Allied Chemical Corp.). Other members of the Steering Committee include Ralph Harris (Du Pont Co.), Fred Coglianese (Johns Manville Products Co.), Frank Kujawa (Durez Plastics Div., Hooker Chemical Corp.) and W. Ashe (Wyandotte Chemical Co.).

Journal of CELLULAR PLASTICS, July, 1965

Scope

Classification of Cellular Plastics

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2. Surface Flame Spread Tests
3. Roof Deck Tests
4. Ignition Temperatures
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4. Plaster Base and Plasterboard Base Insulation
5. Exposed Foam Applications Including Ceiling Tile
6. Roof Deck Insulation
7. Foam Core Panels

Warehousing and Job Site Storage

Material Characteristics

Scope

This bulletin describes the principal building construction areas in which cellular plastics are currently being used. Specific fire hazards associated with each class of application are identified. A discussion of the appropriate fire test procedures

for evaluating these hazards and suggested test limits associated with the safe use of plastic foams are presented. Recommendations are included for selecting the most suitable cellular plastic and best application procedures and environment to ensure maximum fire safety.

Classification of Cellular Plastics

The types of cellular plastics available for use in the area of building construction are shown in *Table I.*

Table I. Rigid and Semi-Rigid Cellular Plastics for Building Construction

CELLULAR PLASTIC	TYPE	DENSITY RANGE, lb./cu.ft.
Urethane	Thermoset	1.5-60.0
Polystyrene	Thermoplastic	0.5-10.0
Polyolefin	Thermoplastic	2.0-30.0
Polyvinylchloride	Thermoplastic	2.0-45.0
Polyepoxy	Thermoset	2.0-25.0
Phenolic	Thermoset	0.1-20.0
Urea	Thermoset	0.3-20.0
Cellulose Acetate	Thermoplastic	6.0- 8.0

Test Methods

It should be emphasized that any flammability test is only a guide to the probable performance of a material in contact with heat or flame under actual use conditions. Since many variables enter into the testing of plastic foams for flammability, different tests may emphasize or de-emphasize the material's characteristics. It is desirable, whenever possible, to evaluate the flammability characteristics of the plastic foam in the end-use application.

Fire protection and building officials rely on several standard, large-scale fire tests for assessing the fire performance be-

havior of building materials. Small scale "bench" tests have their use for quality control and development purposes but are not accepted as a measure of end-use behavior in the field. Accordingly, when plastic foams are used as building components, it is important that data be obtained by the standard tests to furnish the required fire performance information. The location of the foam in a given building (whether exposed as in ceiling tile, or protected as in plaster base, etc.) and the type of occupancy of the building itself (institution, private dwelling warehouse, etc.) are considered by the fire protection official in determining the nature and degree of fire performance the foam-containing building component must display. The tests listed below measure the various fire performance characteristics of importance.

1. Fire Endurance Tests — The length of time a building component is able to safely contain a raging fire without losing structural integrity is defined as its "fire endurance time." The accepted test for this property is ASTM E 119-51. "Fire Tests of Building Construction and Materials." The following direct quote from the method describes the philosophy and scope of the test.

ASTM E 119-61

"Introduction

The performance of walls, columns, floors, and other building members under fire exposure conditions is an item of major importance in securing contructions that are safe, and that are not a menace to neighboring structures nor to the public. Recognition of this is registered in the codes of many authorities, municipal and other. It is important to secure balance of the many units in a single building, and of buildings of like character and use in a community; and also to promote uniformity in requirements of various authorities throughout the country. to do this it is necessary that the fire-resistive properties of materials and assemblies be measured and specified according to a common standard expressed in terms that are applicable alike to a wide variety of materials, situations, and conditions of exposure.

Such a standard is found in the methods that follow. They prescribe a standard exposing fire controlled extent and severity. Performance is defined as the period of resistance to standard exposure elapsing before the first critical point in behavior is observed. Results are reported in units in which field exposure can be judged and expressed.

The methods may be cited as the 'Standard Fire Tests' and the performance or exposure shall be expressed as '2-hr,' '6-hr,' etc.

When a factor of safety exceeding that inherent in the test conditions is desired, a proportional increase should be made in the specified time-classification period.

"Scope

1. (a) These methods of fire tests are applicable to assemblies of masonry units and to composite assemblies of structural materials for buildings, including bearing and other walls and partitions, columns, girders, beams, slabs, and composite slab and beam assemblies for floors and roofs. They are also applicable to other assemblies and structural units that constitute permanent integral parts of a finished building.

(b) It is the intent that classifications shall register performance during the period of exposure and shall not be construed as having determined suitability for use after fire exposure."

Several versions of the furnace are used to accommodate various components such as beams, columns, floors, ceilings, walls, etc. The "Wall Furnace" for example, accommodates a 10′ x 10′ test wall which becomes one side of the furnace. As with the other furnaces, the temperature is increased according to the standard time-temperature curve, which is defined by the following points:

Time, Hr.:Min.	*Temp., °F.*
0:00	68
0:05	1000
0:15	1399
1:00	1700
4:00	2000
8:00	2300

Thermocouples record the temperature on the unexposed side of the wall. The fire endurance time is recorded when the wall "fails." By definition, this is when either a single thermocouple rises 325°F. (163°C.) over starting temperature, or the average of all the thermocouples rises 250°F. (121°C.) above starting temperature. In theory, at this point, a wall would no longer contain a fire, but would permit the ignition of combustible materials in adjoining rooms, thereby allowing the fire to spread. The standard fire protection handbooks contain tables which list fire endurance times for a multitude of building components. These ratings are used for building code and insurance purposes.

For developmental purposes, a small scale version of the wall furnace is often used as a preliminary to full scale testing. The "Pilot" furnace accommodates a 4′ x 4′ test panel and is controlled by the standard time-temperature curve. The same failure criteria are used as in the full scale test. For certain structures, the Pilot furnace approximates full scale results. For other structures, however, the Pilot furnace yields results that are misleadingly optimistic. For example, when a wall with plastic foam covered with plaster is tested in the full scale furnace, the plaster cracks and falls from the wall once the foam is destroyed. In the case of the Pilot furnace, however, the limited area permits the plaster to stand in place even when the foam has been consumed. The resulting "dead air" space gives the wall a rating far beyond that obtained in large scale testing. For this and other reasons, the Pilot furnace is limited to developmental testing and cannot be used for code or rating purposes.

*2. **Surface Flame Spread Tests*** — The purpose of these tests is to measure the rate of flame-spread across the surface of interior finish materials. For obvious reasons of public safety, it is necessary to have surfaces of low flame-spread in critical areas such as exit corridors and other assembly areas in public buildings, institutions, hospitals, etc. As with fire endurance times, flame-spread rates of appropriate building materials are listed in various fire protection handbooks and are referred to for code and rating purposes.

a. ASTM E 84-61 *"Surface Burning Characteristics of Building Materials"*

Commonly referred to as the "Tunnel Test," this method is the standard for flame-spread measurement. The tunnel furnace is 25' in length by 20" in width. The test material comprises the roof of the furnace and flame-spread is encouraged along its underside by controlled air velocity. All test materials are compared against a rating scale determined by two calibration materials — "0" is arbitrarily assigned to cement-asbestos board and "100" to red oak. In terms of actual behavior, flame does not progress across cement-asbestos board whereas flame travels 19.5' across red oak in 5 1/2 minutes.

Most building codes categorize materials according to flame-spread rating and then specify the category required for a given building application. A typical classification follows:

Class	*Flame-Spread Rating*
A *(non-combustible)*	0-25
B	26-75
C	76-200
D	>200

b. Developmental Tests

Several tests are used which are larger than the "bench" tests but which are smaller and easier to run than the Tunnel: These are of considerable use in developmental work but have not been used for code and rating purposes. The 8' tunnel test is one example. Another example is the ASTM E 162-60T "Radiant Panel" test. A relatively small sample is tested — 6" x 18". A radiant burner preheats the sample ahead of the flame front, thereby encouraging the spread of flame. This principle, in actual building fires, accounts for the relatively fast spread of flame across certain structures. A "flame-spread index" rating scale is again established by rating cement-asbestos board 0 and red oak 100. Present data indicate the Radiant Panel rates flame-retardant thermoplastic foams (such as polystyrene) comparable to or

lower than they would be rated by the Tunnel. On the other hand, flame-retardant thermoset foams (such as urethanes) may be rated higher by Radiant Panel than by Tunnel. What this means in actual price has not been established.

3. Roof Deck Tests — Special tests have been designed to measure the fuel contribution potential of various roof constructions when they are exposed to fire from below. It was learned from past experience that certain constructions — specifically, steel decking covered with generous quantities of asphalt to adhere insulation board, followed by a standard built-up roof — could "leak down" sufficient amounts of molten material when heated from below, to create a self-perpetuating fire which would spread throughout the structure, It was later found that limited use of proper adhesives, plus adequate "barrier" properties of the insulation, could limit fuel contribution. The three tests described below are used for roof deck rating purposes.

a. White House Test — This is the original full scale roof deck test. A 20′ x 100′ structure is covered by the roof deck system under test. A standard exposure fire is maintained on one end and the resulting distance of flame-spread is noted over a 30-minute period. The results are compared to those of a "standard" acceptable roof, which consists of steel deck, mechanically secured, 1" vegetable fiber board, followed by a standard 4-ply built-up roof. The White House Test is conducted for rating purposes by the Factory Mutuals Engineering Laborities.

b. Factory Mutuals' "Calorimeter Test" — This test measures the potential fuel contribution of a roof deck system when exposed to a fire from below. Decks which contribute less fuel than the acceptable system described in (a) above, are listed as "Class I" by Factory Mutuals. All other systems are rated "Class II". This test is calibrated against the large White House Test.

c. Tunnel Roof Deck Test — A 30-minute tunnel test is used by Underwriter's Laboratories to test roof deck systems. Distance of flame-spread as a function of time is the rating criterion. Systems which "pass" are listed under various construction types in Section 360 RO of the UL Building Materials List.

4. Ignition Temperatures — ASTM D 1929-62T (Setchkin Test) — This property is not ordinarily quoted in the rating manuals, but is of basic interest when considering flammability behavior of various materials. "Self-Ignition Temperature" is defined as the lowest temperature at which a material will ignite by itself. "Flash Ignition Temperature" is defined as the lowest temperature at which a material will ignite when an external ignition source is present. The test apparatus concists of a heated tube in which the sample is suspended and through which passes an optimum supply of air for combustion. The ignition behavior of the test material is noted at various furnace temperatures until the minimum points are obtained.

Ignition temperatures for several plastic foams are tabulated in the Section titled Material Characteristics. These values are as high, or higher, than those of common combustibles such as wood, paper and cotton.

5. Supplementary small scale tests include:

a. ASTM D 1692-59T — A test for cellular plastics which defines burning rate, extent of burning and self-extinguishment. Test consists of flame contact with the edge of a foam sample and observing flammability characteristics.

b. Underwriter's Laboratories Bulletin 94 — A test similar to ASTM D 1692-59T with the exception that U.L. 94 detects flaming drips.

c. ASTM D 757-49 — A test that defines burning rate, ignition temperature and self-extinguishment. Test consists of ample in contact with glowing hot bar at regulated temperature.

d. Radiant Panel Test (Interim Federal Standard 00136 or ASTM E 162) — A test which defines flame-spread, burning rate and smoke density. The test consists of applying a flame to a sample in front of a radiant panel.

APPLICATION AREAS

1. Perimeter Insulation — Perimeter insulation is any insulation which is applied below ground level along the edges

of a concrete foundation. It is used in both residential and industrial slab type foundations. The insulation is applied beneath the ground and is unexposed; therefore, except during installation, it presents no real fire hazard. Because of this, cellular plastics have been accepted for this application and have been given FHA approval.

The installed foamed perimeter insulation introduces no significant flammability hazard. The only critical flammability hazards which could exist would involve the on-site storage and installation of the foam. The foam would normally be stacked at the site prior to the pouring of the foundation; hence, except for adjacent structures, the building would be non-existent. Therefore, the main hazard involved would be that of flammability with respect to the storage of construction materials.

Flame-retardant foams are preferred but not essentially because of the low degree of life and property hazard.

For safe handling procedures reference should be made to the MCA Safety Guide SG-5 adopted September 1960, "Plastic Foams — Storage, Handling and Fabrication." As described in this bulletin, good housekeeping is essential in elimir.ating the fire hazard potential.

Open flames such as welding torches, matches, salamanders, etc., should be used with proper care to avoid ignition of the foam products.

Slab foam which becomes ignited can be easily controlled and extinguished if caught early. It is therefore recommended that water type fire extinguishers should be accessible during storage and installation of the foam.

In conclusion, it can be said that perimeter insulation using pastic foams offers no flammability hazard after installation. Since a potential flammability hazard exists with stored foam, good housekeeping practices are essential.

2. Cavity Wall Insulation — A masonry cavity wall consists of an inner and outer wall (wythe) separated by an air gap. These two wythes are generally connected with metal ties and the cavity may be filled with insulation.

The masonry cavity wall was accepted by FHA in 1937 "for exterior enclosing walls of dwellings otherwise eligible for mortgage insurance." They are also provided for under the National Code, the Uniform Code (ICBO), the Basic Building Code of the Building Officials Conference of America, and the Southern Code of the Southern Building Code Congress as well as many municipal codes.

Plastic foams, either foamed-in-place, board stock, shredded or pelletized, can be used in the cavity, and greatly improve the resistance to heat flow of masonry cavity walls. The masonry cavity wall concept was developed because of the advantage it offers over solid wall construction in resistance to heat and moisture transmission.

Non-flame-retardant grades of plastic foam, either poured-in-place or as board stock, have been evaluated in masonry cavity wall applications. The need for a flame-retardant foam is not as great as in many other applications, because the foam is totally enclosed by completely non-combustible materials of construction and very little air should be available for combustion inside the cavity. The use data on shredded or pelletized foam are limited and the flammability hazards have not been completely evaluated. In some instances consideration should be given to plastic foams which melt. The performance of cavity walls under fire exposure conditions (*) is

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* Pilot fire tests were conducted (Engineering Experimental Station, Ohio State University, Columbus, Ohio) on a masonry cavity wall consisting of two wythes of 4-inch face brick with metal ties between the wythes, separated by a 2 1/2 inch cavity filled with poured-in-place rigid urethane foam. The time-temperature curve specified for ASTM ME119-55T was followed. THe foam in the wall reached its softening point of about 350°F. in 1 1/4 hours. After this time the wall was still as strong as an uninsulated wall. At 1 3/4 hours, the

an item of major importance to insure that such constructions are safe. ASTM E 119, Standard Methods of Fire Tests of Building Construction and Materials, prescribes a standard exposure fire of controlled extent and severity. Performance is defined as the time required for the heat from a standard fire exposure to penetrate the wall and cause a predetermined temperature rise on the exposed surface and structural integrity.

In conclusion, it can be said that utilization of plastic foam in cavity wall insulation does not offer serious flammability hazards and generally does not reduce the fire endurance rating of the construction.

3. Thermal Insulation on Pipes and Vessels — At the present time, the application of plastic foams as thermal insulation on Pipe, Equipment and Duct Insulation is well accepted in the process industries. Some use has developed in domestic heating and air conditioning equipment.

Fire resistance of thermal insulation in the process industries is important for the following reasons:

a. In case of fire, it is obviously desirable that all property, including insulation, be damaged as little as possible.

b. It is undesirable for any material of construction to contribute fuel to a fire.

c. It is undesirable for any material of construction to ignite readily, to continue to burn after the source of ignition is removed or to spread or propagate fire

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temperature of the inside of the wythe which was exposed to the heat reached 650°F. After this time the foam no longer functioned as insulation, as indicated by a faster rate of temperature rise on the opposite unexposed face of the cavity. Even after four hours, however, the unexposed exterior face opposite the furnace had not yet reached 250°F. above the ambient room temperature (the normal criterion for a specific fire rating under ASTM E119-55T). Based on these tests, a rigid foam-filled wall of the described construction would be considered structurally sound for at least 1 hour.

from one point to another. Spread of fire may occur either by flame or by the more insidious afterglow or "punking."

d. Since thermal insulation in the process industries often protects materials in process which may be hazardous if overheated, it is desirable that insulation have maximum fire endurance in order to delay temperature rise in pipes and vessels. Since these materials in process are frequently under pressure, weakening of the pipe or container because of increasing temperature may also be extremely hazardous.

Fire endurance or the usefulness of insulation to retard temperature rise which may weaken the metal of pipe or vessels or raise the temperature of the contents to a dangerous level has been tested by a number of operators. Usually runs of pipe have been set up and insulated with the materials to be tested. Thermocouples peened into the pipe surface and placed at other strategic locations are used to measure temperature rise. A fire, more or less precisely controlled, is lighted under the test section. Gasoline is commonly used as fuel. The rate at which the temperature of the metal pipe rises is a measure of usefulness of the insulation in reducing the hazard of overheated pipe or vessel and its contents.

Many domestic applications of insulation to pipes and vessels offer little hazard beyond propagation of flame. In these cases, "flame-retardant" grades are usually acceptable.

But, in process industries, the further hazard of temperature rise of pipe and contents in a fire may become an overriding consideration. In fact, it is common practice to provide additional protection by means of fire-retardant jackets, coatings and mastics. It is suggested that the recommendation of the Code and Underwriting groups be adhered to whenever possible.

Where possible, pipes insulated with plastic foams should be separated to reduce the concentration of combustible material in the space.

Automatic sprinklers protect fire hazard and usually reduce insurance rates. Sprinklers have in some cases made the difference between acceptance and non-acceptance by insurance companies.

Use of non-flammable or fire-retardant cements and mastics is recommended.

A vapor barrier over plastic foam insulation is almost universally advised over cool pipes. Fire retardance can be measurably improved by use of a barrier incorporating a metal foil.

It is a growing practice to jacket thermal insulation with sheet metal, such as aluminum or stainless steel, to protect against mechanical damage, improve appearance, reduce maintenance cost, and serve as weather and vapor barrier. It also serves as a fire stop. A steel jacket over foam plastic insulation can reduce rate of temperature rise on a pipe surface to half, or even less, of the rate when the same foam is not jacketed and may hold the ultimate pipe temperature to a much lower level.

Installations are sometimes made using a layer of mineral insulation over the foam insulation to retard both fire and temperature rise.

In conclusion it can be said that:

1. Flame-retardant grades are generally acceptable for domestic use. Greater fire resistance can be obtained by use of fire retardant vapor barrier coatings or metal coverings over the foam.
2. Maximum spacing and use of sprinklers also contribute to greater safety.

4. Plaster Base and Plasterboard Base Insulation — Plastic foams are used as a base for plaster and plaster-board because of high insulation value, good moisture barrier properties, ease of installation and excellent long-term retention of physical and thermal properties. The foams are applied to masonry walls with portland cement mortar or other suitable adhesives.

Plaster or plasterboard is then applied directly as a surface finish. Furring strips and lath are not needed with this technique.

Because the foam is applied directly to the wall and then is covered with plaster or plasterboard, the possibility of ignition is minimized because of isolation from oxygen and ignition sources. Flame-retardant foams are recommended to decrease the possibility of the foam itself contributing to the start of a fire, before and during installation.

It is necessary to know the behavior of a wall with foam plaster base and plaster once it is involved in a fire which has started elsewhere in the room. The two properties of major concern are "flame spread" (*) and "fire endurance." (**)

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* The "rate of surface flame-spread" over an interior surface is measured by the ASTAM E 84-61 "tunnel test". Such tests have been conducted on an assembly consisting of 1" of polystyrene from bonded to 1/8" cement-asbestos board backing with 1/16" portland-cement mortar and covered on the fire side with 1/2" sanded gypsum plaster. The following results were obtained:

1. Flame-spread rating — 3
2. Fuel contribution — negative result obtained
3. Smoke density — 21

** The "fire endurance rating" of a wall is measured by the ASTM E 119 "Wall Furnace Test". This test measures the ability of a wall to contain a standard fire which is raging within. Extended fire endurance times are required in many buildings to slow the spread of fire from one part of the building to another. To further verify the above, a 3 5/8" thick brick walk with 1" polystyrene foam covered with 1/2" gypsum wallboard, exhibited a fire endurance time of 1 hour, 37 minutes. When the brick wall alone was tested, an endurance time of 1 hour, 14 minutes was obtained. The foam plaster base and covering thus added 23 minutes to the endurance time of the wall. This added time is approximately the amount given 1/2" of gypsum wallboard. On this basis, it follows that the foam plaster base neither added to nor detracted from the fire endurance rating of the masonry wall. In Pilot test, no difference in fire endurance behavior between nonflame-retardant and flame-retardant foams was noted.

The above results when compared with Red Oak as 100 and cement-asbestos board as zero, indicate there was no sustained spread of flame and relatively little generation of smoke and no fuel contribution. The plaster effectively shielded the plastic foam from exposure to flame. When 1" flame-retardant foams are tested without plaster cover, the fire retardant polystyrenes exhibit a flame-spread of 10-25 and the urethanes 40-80. It is obvious that 1" flame-retardant foams, by themselves, exhibit relatively low surface flame values and when covered by gypsum plaster, the flame-spread values are even lower. Flame-spread values are determined primarily by the nature of the gypsum plaster finish.

A standard 10' x 10' test wall (***) was constructed of 8" masonry block (of 2-hour fire endurance rating by themselves). 1 1/2" of polystyrene foam was attached with 1/4" of portland cement mortar and finished with a 3-coat, 5/8 inch gypsum plaster with sand aggregate.

With the plaster side exposed to the fire, an endurance time of 2 hours, 38 minutes was obtained. After 20 minutes of fire exposure, the foam was consumed. The masonry wall, by itself, was then exposed until the end-point was reached. Since 5/8" of plaster normally adds approximately 30 minutes to the rating of a wall, it can be concluded this wall behaved comparably to an 8" masonry wall plastered directly with 5/8" of plaster.

Generally, when a flame-retardant plastic foam is adhered to a wall with a suitable adhesive and finished with 5/8" of plaster or 1/2" of gypsum wallboard, the following flammability properties will be obtained:

a. Excellent resistance to chance ignition because of complete protection of the foam by the wall and the finish.

b. Low surface flame-spread rate, determined primarily by the finish.

*** Engineering Experimental Station, Ohio State University, Columbus, Ohio.

c. Unchanged fire endurance time of the basic wall

5. Exposed Foam Applications Including Ceiling Tile — The types of applications which would fall into this category include:

a. Exposed foam in cold storage rooms

b. Exposed foam in buildings

c. Exposed foam used for sound absorption and deflection

d. Exposed foam as ceiling tile

e. Miscellaneous exposed applications

These applications must take into consideration the classification of a building with respect to occupancy and type of construction. This would involve using the classifications outlined by the various building official conferences. Before exposed foam is used, it must comply with the flammability requirements outlined for the specific building and occupancy classification to which it applies.

The following classification is from the Building Officials Conference of America and is representative of the other building official conferences:

Classifications based on types of construction

Type	
1	Fireproof construction
2	Non-combustible construction
3	Exterior masonry wall
4	Frame

Classification based on occupancy

Group		*Exposed Foam*
A	High hazard	(*)
B	storage	Applicable
C	Mercantile	(*)
D	Industrial	Applicable

E	Business	Applicable
F	Assembly	(*)
H	Institutional	(*)
L	Residential	Applicable
M	Miscellaneous	Applicable

For this particular application all of the known categories of flammability hazards must be considered. They are as follows:

a. surface flame-spread

b. dripping and distortion

c. fuel contribution

d. smoke density

One test method which evaluates the above mentioned flammability hazards is the Underwriters' Tunnel Test (ASTM E 84-61).

The acceptable performance levels in these tests are established by the various Codes and Underwriting groups.

In all exposed foam applications, the foam used should be flame-retardant. Foam used for overhead applications (such as ceiling tile or sound deflectors) should not drip or splatter burning materials when exposed to flames. Any applied facings or joint assemblies should also be flame-retardant.

In applications where the exposed foam surface area is large, sprinklers may be effective. It is recommended that even in applications where adequate sprinkler protection exists, safe application procedures should be adhered to.

In conclusion, it can be said that plastic foams of low flame-spread can be used in exposed foam applications such as ceiling tile. Utilization in many applications is dependent upon the occupancy classification of acceptable Building Codes.

6. Roof Deck Insulation — Plastic foams are used roof deck insulation because of low heat transmission, high impact re-

* Use in area of high occupancy cannot be recommended until additional test data are accumulated.

sistance, high compressive strength, low water-vapor transmission and low installation costs. The foams are bonded to metal, wood, concrete or gypsum decks and then topped by a standard built-up roof. In many applications, this system is readily accepted and its use presents no problem. In certain large area industrial applications, however, special precautions are necessary to achieve a system with suitable fire behavior. The major consideration is when a fire exists in an area below the roof. If combustibles in the roof become available fuel, the existing fire is worsened and a spreading, self-perpetuating fire results. Because of their heavy fire resistive nature, concrete and gypsum decks pose no problem in this area. Metal decks, however, must be of special construction in order to meet safety requirements.

Several large scale tests have been developed to determine suitable safety standards for metal roof deck assemblies.(*) See Section titled Test Methods.

In all of these construction tests, an insulating barrier must be imposed between deck and roof. Plastic foams that offer no resistance under fire conditions would require one inch of fiber board or other barrier over the deck and under the foam in order to qualify.

In conclusion it can be stated that:

a. In many applications, plastic foams offer excellent service in roof decks and are fully accepted.

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* Suitable decks are listed in Section 360 RO of the UL Building materials list. Briefly, the following constructions have been accepted:

1. Steel Deck — 1" vegetable fibre board — limited, special adhesive — built-up roof.
2. Steel Deck — 1" mineral fibre board, etc.
3. Steel Deck — 1 1/4" expanded perlite, etc.
4. Wood Deck — 3/4" tongue and grooved Douglas fir plywood, 0.002" aluminum sheet — 1" vegetable fibre board, etc.
5. Wood Deck — 1" tongue and grooved Douglas fir lumber — 0.002" aluminum sheet — 1" vegetable fibre board, etc.

b. Plastic foams are not suitable for steel deck unless underlaid by a barrier such as fiber board. No problem exists with concrete and gypsum decks.

7. ***Foam Core Panels*** — Plastic foams are used as core material in sandwich panels because of low heat transmission, rigidity, light weight, moisture proofness and chemical inertness. Facing materials commonly used include, metals, plywood, hardboard, cement-asbestos board, reinforced plastic, tempered glass and concrete.

Sandwich panels may be either load bearing or non-load bearing and are used in both residential and commercial construction. A relatively high degree of fire resistance is required for load bearing panels used in large commercial buildings. Non-load bearing residential applications require a lower level of fire resistance.

The following flammability properties are of importance:

a. Since the foam core is isolated from small ignition sources by the facing material, ignition resistance depends primarily upon the degree of protection afforded by the facing. The elimination of an internal dead air space by the foam core prevents the internal spread of fire within the panel due to "chimney effect."

b. The surface flammability also depends upon the nature of the facing material. In areas of public congestion where low flame-spread surfaces are mandatory, a suitable facing should be used and performance of the panel demonstrated by the ASTM E 84 "Tunnel Test." The building code in effect will specify the maximum flame-spread value allowable. Some building codes specify a test of the core material by itself, as well as of the facing material. For this reason, and for general ignition resistance, the use of flame-retardant foams is recommended.

Commercial buildings in crowded city areas are required by the local building code to be constructed of walls and floors which exhibit specific fire endurance

times (*) in order to retard the spread of fire from one area to another. Standard ASTM E 119 test values must be used for such ratings. Tests are conducted as either "load bearing" or "non-load bearing," depending on the ultimate use of the wall.

In conclusion, it can be stated that foam core sandwich panels exhibit the following flammability characteristics:

1. Resistance to small ignition sources and to surface flame-spread is primarily determined by the nature of the facing material.
2. Fire endurance time is primarily determined by the nature, application and thickness of the facings. Large scale ASTM E 119 tests are required to determine actual ratings of specific structures.

WAREHOUSING AND JOB SITE STORAGE

In the past, the majority of fires involving foams have taken place where large quantities of the material were stored in relatively small areas with unsafe use of igniting devices. This condition exists in warehousing and job site storage of foams during construction and installation. The continuous use of

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* For illustrative purposes, the following Pilot Furnace test data** indicates the relative behavior of various sandwich panel constructions. These values cannot be used for code or rating purposes.

Panel Description (4' x 4')	Pilot Furnace Endurance Time
1 1/2" Flame Retardant Polystyrene Foam, 1/4" Plywood Faces	11 minutes
1 1/2" Flame Retardant Polystyrene Foam, 1/8" Cement-Asbestos-Board Faces	13 minutes
1 1/2" Urethane Foam, 1/8" Cement-Asbestos-Board Faces	14 minutes
1 1/2" Polystyrene Foam, 1/2" Latex Concrete Faces	33 minutes
1 1/2" Polystyrene Foam, 1 1/2" Reinforced Concrete Faces	2 hours
1" Polystyrene Foam, 1" Reinforced Concrete Faces	1 hour, 15 minutes

** Dow Chemical Company, Midland, Michigan

cutting and welding torches and other flame sources combined with the combustible debris found on many job sites has resulted in fires involving stacks of foam.

1. Job Sites — The fire problem of job site storage has been minimized by the use of flame-retardant foams which resist ignition from small or temporary ignition sources. In addition, an educational program has served to alert construction workers to the proper safety and housekeeping steps necessary to prevent fires. A good example of this program is MCA Safety Guide SG-5 "Plastic Foams, Storage, Handling and Fabrication," which is available from Manufacturing Chemists' Association, Inc., 1825 Connecticut Avenue, N.W., Washington 9, D.C. The use of SG-5 is recommended as an extension of this section of the manual.

2. Warehousing — A somewhat different approach is required for safe storage of foams in permanent warehouse facilities. In addition to good housekeeping and safety practices, it is necessary to provide efficient fire-alarm service and fire-fighting equipment. Approved automatic sprinkler protection is desirable to restrict or extinguish chance fires. Piles of foam should be limited in height to permit efficient sprinkler operation. Aisle ways and corridors should be maintained between piles of foam to permit access by fire fighters. Liberal and proper application of water by hose stream is an effective method of extinguishing fires in plastic foam.

1. Fire Endurance Time — ASTM E 119-61 — Although foams by themselves do not exhibit high fire endurance times, generally, when a building construction system is required to exhibit a certain degree of fire endurance, the plastic foam which may be present as plaster base, cavity wall insulation, etc., is generally considered to neither add to nor detract from the endurance time of the basic masonry portion of the structure. Specific tests are required for various types of applications.

2. Smoke Evolution — Plastic foams, like many other organic materials, generate black smoke when burning. To

date, however, test methods have not been developed to realistically establish acceptable limits.

Table II. Typical Physical Properties of Plastic Foams used in Construction Applications

PROPERTY	POLY-STYRENE	URETHANE	POLY-ETHYLENE
Density, lb./ft.^{3}	1.0-3.0	1.5-2.5	2.0
Insulation Value (K-factor, B.T.U.-in/hr°F.ft^3)	0.24-0.30	0.14-0.16	0.35
Linear Coefficient of Thermal Expansion, in/in-°F.	$4x10^{-5}$	$5x10^{-5}$	$8x10^{-5}$
Maximum Temperature for Continuous Use, °F.	170-180	250	160

Table III. Typical Thermal and Flammability Properties

PROPERTY	POLY-STYRENE*	URETHANE*	POLY-ETHYLENE*	WOOD
Heat of Combustion				
B.T.U./lb	16,000	11,000	16,000	8,000
B.T.U./ft.^{3}	32,000	22,000	32,000	320,000
B.T.U./board foot	2,660	1,840	2,660	26,600
Ignition Temperature (ASTM D 1929-62T)				
Flash Ignition Temp., °F.	650-700	600	650	500
Self Ignition Temp., °F.	735-915	975	660	500
Surface Flame Spread (ASTM E 84-61 "Tunnel Test")	10-25**	40-80**	Non FR	100 (Red Oak)

* Based on a density of 2.0 lb./cu.ft.
** Flame-retardant grades.

3. Toxicity of Combustion Products — The products of combustion of polystyrene have been thoroughly investigated. An independent research laboratory, after exposing animals to polystyrene combustion products, concluded the effects were no worse than those expected from exposure to common combustibles used in building construction. A private study of the nature and composition of the products of combustion of polystyrene similarly concluded they were essentially the same as those of other building materials.

A similar study on urethane foams showed the toxicity of combustion products are also generally equivalent to wood, paper, and other conventional building materials.

4. General Burning Characteristics — In addition to the large scale test data presented elsewhere, it is of practical interest to consider the effect of igniting various quantities of foams with various ignition sources.

5. Small Quantities (1 board foot) —- When ignited with match, Bunsen burner or propane torch, flame-retardant polystyrene and urethane foams burn with yellow flame and black smoke during ignition, but extinguish within 0-10 seconds after flame removal.

6. Large Area Applications — The behavior of large surface areas can be measured by the Tunnel "flame-spread" test. The 10-25 rating of flame-retardant polystyrene foams result from a melting of the foam at the point of flame application with subsequent interruption of the flame path. There is no sustained or progressive spread of flame across such an area. The 40-80 rating of flame-retardant urethanes results from a retarded spread of flame across the surface (compared with wood as 100). The thermoset nature of urethane foam prevents melting and interruption of the flame path, as compared with thermoplastic foams.

7. Large Stacks of Foams —- Large volume conditions (as opposed to the above large area condition) presents a different situation. Generally, all flame-retardant foams will burn if a large volume is given sufficient ignition. Temporary or small "surface-ignition" sources pose no problem but continued ignition in a recess in the foam (forming a chimney) results in an eventual self-sustaining ignition of the stack of foam. Once started, the stack burns rapidly and intensely. When such a fire is in progress, the stacks of foam are easily "knocked down" by adequate hose stream application. Fog applicators are particularly effective against the flame, with the solid stream application used to topple burning stacks of foam. As with fire fighting in general, it is necessary to get water to the

point of ignition in order to absorb the heat generated by the fire and cool the fuel below its ignition temperature. The low density, low specific heat and high ignition temperature make it relatively easy to cool plastic foams below the ignition point with water.

2001.05 MATERIALITY UNDER 37 CFR 1.56(a) [R-2]

Subsection 1.56(a) provides,

"All such individuals have a duty to disclose to the Office information they are aware of which is *material to the examination* of the application (emphasis added)."

"Material" connotes something more than a trivial relationship. It appears commonly in court opinions. Subsection 1.56(a) elucidates,

"Such information is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent."

This sentence paraphrases the definition of materiality used by the Supreme Court in TSC Industries v. Northway, 426 U.S. 438, 48 L.Ed. 2d 757, 96 S.Ct. 2126, 44 U.S.L.W. 4852 (1976). Although in that case the court was concerned with rules promulgated by the Securities and Exchange Commission, the Court's articulation of materiality is believed consistent with the prevailing concept that has been applied by lower courts in patent cases.

The definition of materiality in §1.56 has to be interpreted in the context of patent law rather than securities law. Principles followed by courts in securities cases should not be translated to patent cases automatically. It is noteworthy, however, that in formulating the definition of materiality in TSC Industries the Supreme Court noted that the standard of materiality should not be so low that persons would be "subjected to liability for insignificant omissions or misstatements," or so low that the fear of liability would cause management "simply to bury the shareholder in an avalanche of trivial information a result that it is hardly conducive to informed decision making."

Although the third sentence of §1.56(a) refers to decision of an examiner, the duty of disclosure applies in the same man-

ner in the less common instances where the official making a decision on a patent application is someone other than an examiner, e.g., a member of the Board of Patent Interferences or the Board of Appeals. This is implicit in the duty "of candor and good faith" toward the "Office" that is specified in the first sentence of §1.56(a).

The Court in Norton v. Curtiss, 433 F.2d 779, 167 USPQ 532, 544 (C.C.P.A. 1970) characterized "materiality" as being of "critical concern;" and indicated,

"[I]n patent cases, materiality has generally been interpreted to mean that if the Patent Office had been aware of the complete or true facts, the challenged claims would not have been allowed."

However, the court then indicated at page 545 of the USPQ citation its concern that "materiality" not be defined too narrowly by stating that

"the above test cannot be applied too narrowly if the relationship of confidence and trust between applicants and the Patent Office is to have any real meaning. Findings of materiality should not be limited only to those situations where there can be no dispute that the true facts, or the complete facts, if they had been known, would most likely have prevented the allowance of the particular claims at issue or alternatively, would provide a basis for holding those claims invalid."

* * * * *

"It is our view that a proper interpretation of the 'materiality' element of fraud in this context must include therein consideration of factors apart from the objective patentability of the claims at issue, particularly (where possible) the subjective considerations of the examiner and the applicant. Indications in the record that the claims at issue *would* not have been allowed but for the challenged misrepresentations must not be overlooked due to any certainty on the part of the reviewing tribunal that the claimed invention, viewed objectively, *should* have been patented. If it can be determined that the claims

would *not* have been allowed *but for* the misrepresentation, then the facts were material regardless of their effect on the objective question of patentability."

Other courts have also treated the question of "materiality." Thus, in In re Multidistrict Litigation Involving Frost Patent, 185 USPQ 729, 741 (D.Del. 1975), the court characterized the question of "materiality" as follows:

"Some variation of the so-called 'but for' test has appeared in nearly every patent fraud case.

* * * * *

"In other words, a finding of fraud is warranted if, but for the misconduct of the patent applicant, the patent would not properly have issued. This is what has been referred to as an "objective but for test."

* * * * *

"The second 'but for' test is the so-called 'subjective test.' This test requires a court to examine the effect which fraudulent representations had upon the examiner. If misrepresentations caused the examiner to issue the patent, then this kind of 'but for fraud' will be found.

* * * * *

"The final 'but for' test has been labeled 'the but it may have' test, i.e., courts look to whether the misrepresentations made in the course of the patent prosecution may have had an effect on the examiner.

* * * * *

"Hence, in this Circuit, a misrepresentation which makes it 'impossible for the Patent Office fairly to assess [the] application against the prevailing statutory criteria . . . will, given the requisite intent, lead to a finding of invalidity.'"

2004 Aids to Compliance With Duty of Disclosure [R-2]

While it is not appropriate to attempt to set forth procedures by which attorneys, agents, and other individuals may ensure compliance with the duty of disclosure, the following are offered as examples of possible procedures which could help avoid problems with the duty of disclosure:

1. Many attorneys, both corporate and private, are using letters and questionnaires for applicants and others involved with the filing and prosecution of the application and checklists for themselves and applicants to ensure compliance with the duty of disclosure. The letter generally explains the duty of disclosure and what it means to the inventor and assignee. The questionnaire asks the inventor and assignee questions about

- the origin of the invention and its point of departure from what was previously known and in the prior art,
- possible public uses and sales,
- prior publication, knowledge, patents, foreign patents, etc.

The checklist is used by the attorney to ensure that the applicant has been informed of the duty of disclosure and that the attorney has inquired of and cited material prior art.

The use of these types of aids would appear to be most helpful in identifying prior art and may well help the attorney and the client avoid or more easily explain a potentially embarrassing and harmful "fraud" allegation.

2. Ask questions about inventorship. Who is the proper inventor? Are there disputes or possible disputes about inventorship? If there are questions, call them to the attention of the Patent and Trademark Office.

3. Ask questions of the inventor about the disclosure of the best mode. Make sure that the best mode is described. The disclosure of the best mode is becoming more and more important in litigation. See for example, Carlson "The Best

Mode Disclosure Requirement in Patent Practice," Vol. 60, Journal of the Patent Office Society, page 171 (1978).

4. Make certain that the inventor, especially a foreign inventor, recognizes his or her responsibilites in signing the oath or declaration. Note that 37 CFR 1.69 requires that,

(a) Whenever an individual making an oath or declaration cannot understand English, the oath or declaration must be in a language that such individual can understand and shall state that such individual understands the content of any documents to which the oath or declaration relates.

5. Carefully evaluate and explain to the applicant and others involved the scope of the claims, particularly the broadest claims. Ask specific questions about possible prior art which might be material in reference to the broadest claim or claims. There is some tendency to mistakenly evaluate prior art in the light of the gist of what is regarded as the invention or narrower interpretations of the claims, rather than measuring the art against the broadest claim with all of its reasonable interpretations. Pick out the broadest claim or claims and measure the materiality of prior art against a reasonably broad interpretation of these claims.

6. Evaluate the materiality of prior art from the viewpoint whether it is the closest prior art. This will tend to put the prior art in better perspective. However, §1.56 may still require the submission of prior art which is not as close as that of the record.

7. Care should be taken to see that prior art cited in a specification or in a prior art statement is properly described and that the prior art is not incorrectly or incompletely characterized. It is particularly important for an attorney or agent to review, before filing, an application which was prepared by someone else, e.g., a foreign application. It is also important that an attorney or agent make sure that foreign clients understand the requirements of the duty of disclosure, and that the U.S. attorney or agent review any prior art statements or citations to ensure that compliance with §1.56 is present.

8. Care should be taken to see that inaccurate statements or inaccurate experiments are not introduced into the specification, either inadvertently or intentionally. For example, stating that an experiment "was run" or "was conducted" when in fact the experiment was not run or conducted is a misrepresentation of the facts. Also, misrepresentations can occur when experiments which were run or conducted are inaccurately reported in the specification, e.g. an experiment is changed by leaving out one or more ingredients. See *Steierman* v. *Connelly et al,* 192 USPQ 433 (PTO Bd. of Pat. Int. 1975); 192 USPQ 446 (PTO Bd. of Pat. Int. 1976).

9. Do not rely upon the examiner of a particular application to be aware of other applications belonging to the same applicant or assignee. Call such applications to the attention of the examiner if there is any question that they might be "material to the examination" of the application the examiner is considering. Be particularly careful that prior art in one application is cited to the examiner in other applications to which it would be material. Do not assume that an examiner will necessarily remember, when examining a particular application, other applications which the examiner is examining, or has examined. See Armour & Co. v. Swift & Co., 175 USPQ 70, 79 (7th Cir. 1972).

10. When in doubt, submit prior art information. Even though the attorney, agent, or applicant doesn't consider it necessarily material, someone else may see it differently and embarassing questions can be avoided.

11. Particularly submit information about prior uses and sales even if it appears that they may have been experimental, not involve the specifically claimed invention, or not encompass a completed invention.

12. Submit prior art promptly. An applicant, attorney or agent who is aware of prior art and its significance should submit same early in prosecution and not wait until after allowance.

13. Don't submit long lists of prior art if it can be avoided. Eliminate clearly irrelevant and marginally pertinent cumulative prior art. If a long list is submitted, highlight those references which may be of most significance. The decisions of the courts make clear the necessity for doing this; see Penn Yan Boats, Inc. v. Sea Lark Boats, Inc., 359 F.Supp. 948, 175 USPQ 260 (S.D.Fla. 1972), affirmed, 479 F.2d 1338, 178 USPQ 577 (5th Cir. 1973), certiorari denied 414 U.S. 874 (1974).

14. Watch out for continuation-in-part applications where intervening prior art may exist; particularly watch out for foreign patents and publications related to the parent application and dated more than one year before the filing date of the CIP. These and other intervening references may be material prior art: In re Ruscetta and Jenny, 118 USPQ 101, 104 (C.C.P.A. 1958); In re von Lagenhoven, 458 F.2d 132, 173 USPQ 426 (C.C.P.A. 1972); Chromalloy American Corp. v. Alloy Surfaces Co., Inc., 339 F.Supp. 859, 173 USPQ 295 (D.Del. 1972).

15. Watch out for intervening prior art in late claiming situations under the Muncie gear doctrine: Muncie Gear Works, Inc., v. Outboard Marine & Mfg. Co., 315 U.S. 759, 53 USPQ 1, 5 (Sup.Ct. 1942); see also Faulkner v. Baldwin Piano and Organ Co., 195 USPQ 410, 415 (7th Cir. 1977).

16. Watch out for information that might be deemed to be prior art under Section 102(f) and (g).

Section 102(f) of Title 35 United States Code may be combined with Section 103; see Corning Glass Works v. Schuyler, 169 USPQ 193 (D.D.C. 1971), aff'd in Corning Glass Works v. Brenner 175 USPQ 516, (D.C. Cir. 1975) where the District Court adopted defendant's post trial memorandum on 102(f) and 103; Halliburton v. Dow Chemical, 182 USPQ 178, 186 (N.D.Okla. 1974); Dale Electronics v. R.C.L. Electronics, 180 USPQ 225 (1st Cir. 1973).

Note also that prior invention under §102(g), may be combined with Section 103, such as in In re Bass, 474 F.2d 1276, 177 USPQ 178 (C.C.P.A. 1973).

17. Watch out for information picked up by the inventors and others at conventions, plant visits, in-house reviews, etc; see, for example, Dale Electronics, Inc. v. R.C.L. Electronics, Inc., 180 USPQ 225, 228 (1st Cir. 1973).

18. Make sure that all of the individuals who are subject to the duty of disclosure, such as spelled out in §1.56 are informed of and fulfill their duty.

19. Finally, if prior art was specifically considered and discarded as not material, this fact might be recorded in an attorney's file or applicant's file, including the reason for discarding it. If judgment might have been bad or something might have been overlooked inadvertently, a note made at the time of evaluation might be an invaluable aid in explaining that the mistake was honest and excusable. It could be helpful in recalling and explaining actions in the event of a question of "fraud" raised at a later time. [R-5]

Opposition

Office - Supreme Court, U.S.
FILED
NOV 3 1981
ALEXANDER L. STEVAS
CLERK

No. 81-689

IN THE

Supreme Court of the United States

October Term, 1981

GREFCO, INC.,

Petitioner,

v.

KEWANEE INDUSTRIES, INC.,

Respondent.

On Writ of Certiorari to the United States Court of Appeals for the Third Circuit

BRIEF FOR RESPONDENT IN OPPOSITION

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QUESTION PRESENTED FOR REVIEW.

Whether the standard of materiality for patent fraud applied below, consistently with the current standard of the other circuits—namely, that fraud requires a misrepresentation that "makes it 'impossible for the Patent Office fairly to assess [the patent] application against the prevailing statutory criteria' "—should be changed.

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No. 81-689

IN THE

Supreme Court of the United States

OCTOBER TERM, 1981

GREFCO, INC.,

Petitioner,

v.

KEWANEE INDUSTRIES, INC.,

Respondent.

BRIEF FOR RESPONDENT IN OPPOSITION.

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

STATEMENT OF THE CASE.

The petition seeks review of a district court decision which held a patent invalid on five separate grounds, affirmed without opinion by the circuit court. It does not

seek review of three grounds (A-7-31) but only of the two grounds of fraud (A-31-52). As to those two, the petition does not question the district court's conclusion that the fraud was "an affirmative intent to deceive or at least a gross negligence or recklessness in misrepresenting the truth" (A-31), in both instances (A-38, 52), but only the standard of materiality said to have been applied (Pet. 3).

In its Statement of the Case, the petition states facts contrary to affirmed findings of the trial court. These factual contentions do not deserve a textual correction;[1] nor does the petition's mischaracterization of the district court's reasoning.[2] Far more serious is the distortion of the standard of materiality applied below.

---

1. The suggestion that the product tested in 1967 was the "identical product" (Pet. 4) which was successfully developed later is unfounded; indeed, at trial Grefco took pains to contend that the 1967 prototypes were made by a different process and were "kerfed" or slit, such that the 1967 tests were invalid (see A-43, 45). Also, the contention that the Grefco inventors "believed the product would pass the UL tunnel test" (Pet. 4) is contrary to the evidentiary admissions that the inventors doubted just that, as set out in the findings below (A-48).

2. It is not true that ". . . the courts below did not give weight to these facts [Coglianese's authorship of the JCP article and his patent proceedings] in adjudicating the issue of fraud" (Pet. 4). The district judge addressed "these facts" in the context of Grefco's only contention about them (A-28), and Circuit Judge Adams during oral argument focused his attention to them specifically on the issue of fraud.

It is not true that ". . . the inventors were not permitted to rely on their expert (and correct) appraisal of the tests" (Pet. 5). The district court found that the appraisal was the attorneys' "afterthought" and that contemporaneous records and the inventors own testimony demonstrated that the inventors were at most puzzled by the repeated failures (see A-43, 45 & n. 30).

ARGUMENT.

The reasons advanced for granting the writ are either insignificant or illegitimate. There is no current conflict among the circuits;[3] recent decisions of the First, Second, Third, Seventh and Tenth Circuits each applied a standard which is equivalent to the subjective "but for" test—the standard applied here. See pp. 3-4, *infra*. The petition's repeated contention that the courts below applied a "might have" test (Pet. i, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 15) rests upon a false statement of the standard applied below and upon a shocking misquote—a district court statement in an earlier case attributed to the circuit court (Pet. 7. n. 7). See p. 5, *infra*. Moreover, the "uniform and workable" standard of this Court which the brief says should be implemented (Pet. 10) was adopted by the Patent and Trademark Office in 1977 and now governs the conduct of patent practitioners. See p. 8, *infra*. Finally, the fraud in this instance is so clearly and convincingly material as to meet any standard.

I. The Circuit Courts Currently Apply a Common Standard of Materiality.

The historical evolution of the standard of materiality in patent fraud was first expressed in the *Frost*[4] opinion of the Delaware District Court and most recently in the *Plastic Container*[5] opinion of the Tenth Circuit. Early

3. Historically, the Third Circuit, for instance, has considered each of the three standards (see Pet. 7-8). Indeed, it applied first the strict standard in 1967, then the lenient standard in 1972, before settling upon the current intermediate standard in 1976. See pp. 3-5, *infra*.

4. *In re Multidistrict Litigation Involving Frost Patent*, 398 F. Supp. 1353, 1368-69 (D. Del. 1975), *modified*, 540 F. 2d 601 (3d Cir. 1976).

5. *Plastic Container Corp. v. Continental Plastics of Oklahoma, Inc.*, 607 F. 2d 885, 898-900 (10th Cir. 1979), *cert. denied*, 444 U. S. 1018 (1980)

cases applied a strict "but for" test which required a showing that the patent should not have been issued and that the fraud caused the patent to issue.[6] A decade ago, the standard was liberalized, and fraud was found if the patent examiner "might have" rejected the application absent the misrepresentation.[7] Ultimately, an intermediate standard, the subjective "but for" test, was settled upon by the courts,[8] which requires a substantial likelihood that the misrepresentation affected the examiner's actions. There is no current conflict, and no case says there is one.

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6. *E.g., Corning Glass Works v. Anchor Hocking Glass Corp.*, 253 F. Supp. 461, 469 (D. Del. 1966), *modified*, 374 F. 2d 473 (3d Cir.), *cert. denied*, 389 U. S. 826 (1967).

7. See *Trio Process Corp. v. L. Goldstein's Sons, Inc.*, 461 F. 2d 66, 73 (3d Cir.), *cert. denied*, 409 U. S. 997 (1972) (distinguishing *Monsanto Corp. v. Rohm & Haas Co.*, 456 F. 2d 592 (3d Cir.), *cert. denied*, 407 U. S. 826 (1972)).

8. *Digital Equip. Corp. v. Diamond*, 653 F. 2d 701, 716 (1st Cir. 1981) ("such as to have a likely effect on the scope of allowable claims or the issuance of the patent"); *Timely Prods. Corp. v. Arron*, 523 F. 2d 288, 298 (2d Cir. 1975) ("the patent examiner would not have withdrawn . . . a reference"); *In re Multidistrict Litigation Involving Frost Patent*, 540 F. 2d 601, 604 n. 9 (3d Cir. 1976) ("misrepresentation is material if it makes it 'impossible for the Patent Office fairly to assess [the patent] application against the prevailing statutory criteria' "); *CTS Corp. v. Piher Int'l Corp.*, 527 F. 2d 95, 100 (7th Cir. 1975), *cert. denied*, 424 U. S. 978 (1976) ("the improbability that a [withheld] patent . . . would affect the Examiner's evaluation"); *Plastic Container, supra* at 900 n. 31 (10th Cir.) ("subjective test . . . looks to the *reasonable probability* that the misrepresentation caused the examiner to approve the claims") (original emphasis); *Norton v. Curtiss*, 433 F. 2d 779, 795 (C. C. P. A. 1970) ("proper interpretation of the 'materiality' element of fraud . . . must include . . . the subjective considerations of the examiner and the applicant").

II. The Third Circuit Standard Is Not the "Might Have" Test.

The characterization of the Third Circuit materiality standard as a "'might have' test" (*e.g.*, Pet. 8) is an illusion. It depends principally upon a misquotation attributed falsely to that Court in footnote 7 of the petition (Pet. 7). In fact the indented quotation is not the Third Circuit's language. It is from the district court opinion in *Frost*, and even that quotation is out of context.[9] Nothing in the Third Circuit decision states that the "might have" test was ever applied.[10] Indeed, the fact that the *Frost* circuit court omitted the "might" reference to *Trio Process* (made in the district court opinion)—and set forth the subjective "but for" test of *Monsanto*[11]—only reinforces the fact that its standard is not the "might have" test (*compare* 540 F. 2d at 604, n. 9 *with* 398 F. Supp. at 1369).

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9. *In re Multidistrict Litigation Involving Frost Patent*, 398 F. Supp. 1353, 1369 (D. Del. 1975), *modified*, 540 F. 2d 601, 604 n. 9 (3d Cir. 1976). The district judge emphasized the word "might" in *Frost* not to set the standard but to explain that the Third Circuit in 1972 had relaxed the strict "but for" test he had formulated in *Corning Glass*, *supra* n. 6. The word "might" comes from the explanation of the *Trio Process* court in distinguishing *Monsanto*, *supra* n. 7 ("on the facts of this case, such [misrepresentations] were not material. . . . [*Monsanto*] is distinguishable because there . . . the patent might not have issued.") (461 F. 2d at 73).

10. In *Trio Process* the alleged misrepresentation "did not relate to the statutory conditions" (461 F. 2d at 73). Thus, even the lenient "might have" test was not met.

11. Notably, both the First and Tenth Circuits have read the Third Circuit standard as applying the intermediate, subjective "but for" test. See *Digital Equip.*, *supra* at 716 (citing *Frost*); *Plastic Container*, *supra* at 900 (quoting a citation to *Monsanto*).

III. The Third Circuit Standard Applied Here Was Not the "Might Have" Test.

This case involves two instances of fraud: withholding anticipatory prior art (A-36-38) and falsifying test results (A-39-52).

The first is the most concrete sort of fraud. To withhold prior art which teaches the patented invention is material fraud without question. Even the most stringent, objective "but for" test is met.

Nevertheless, the petition endeavors to say that the district court applied a "might have" test in even this instance (Pet. 3). Once again, however, the source for the word "might" is illegitimate. The citation is A-49-50 (Pet. 3), but there the district court discussed the second fraud—not the first. Where the first was discussed (A-36-38), the inescapable conclusion on materiality was that the fraud "goes to the very heart of the Examiner's task." (A-38).

Nor did the district court apply the "might have" test to the second fraud. Having stated the *Frost* standard of subjective "but for" materiality (A-31), the district judge concluded that the fraud "prevented the Examiner from fairly assessing the Bolster application against the applicable statutory criteria of utility, anticipation *and* obviousness" (A-50, emphasis supplied). Thus, the fraud was material in three respects: knowing the full truth the Examiner could have rejected the application in a variety of ways. He "might" have rejected because the actual tests disproved utility; he "might" have rejected because the tests proved the composite was not new; he "might" have rejected because the test failures rebutted the claim of superiority; or he "might" have rejected on all three grounds (see A-49-50).[12] In any event, he *would* have

12. Also he could have stricken the application on the ground of fraud. See *Digital Equip.*, *supra* at 707 (quotation of Patent Office Rule 56 in effect from 1949 to 1977).

rejected because the truth did not support any basis for patentability. The subjective "but for" test was thrice met.

IV. The Third Circuit Standard Does Not Conflict With Decisions of This Court.

This Court has never seen the need to set a standard of materiality in patent fraud, and given the current conformity of the law on the point, there is no need now. Neither case cited in the petition (Pet. 11) [13] set a standard. Indeed, as explained by the district judge in *Frost*, the Third Circuit standard is based upon "leading Supreme Court decisions" which do not require the strict "but for" test (398 F. Supp. at 1369).[14]

> Further, the Third Circuit standard for patent fraud:
>
> An omission or misrepresentation is material if it makes it "impossible for the Patent Office fairly to assess [the patent] application against the prevailing statutory criteria." [15]

seems if anything more stringent than this Court's standard for securities fraud:

> An omitted fact is material if there is a substantial likelihood that a reasonable shareholder would consider it important in deciding how to vote.[16]

---

13. *Walker Proc. Equip., Inc. v. Food Mach. & Chem. Corp.*, 382 U. S. 172 (1965); *Corona Cord Tire Co. v. Dovan Chem. Corp.*, 276 U. S. 358 (1928).

14. The court also explained that *Walker Process* addressed fraud in an antitrust context and that *Corona Cord Tire* considered the effect of false affidavits upon "[t]he reasonable presumption of validity" (398 F. Supp. at 1365 n. 22, 1366).

15. *Frost, supra* at 604 n. 9.

16. *TSC Indus., Inc. v. Northway, Inc.*, 426 U. S. 438, 449 (1976).

The petitioner can hardly complain if its fraud was measured by a standard more stringent than that which this Court would apply under the very reasoning of the petition.

V. The Materiality Standard for Patent Practitioners Is Not "Unreasonable" Nor "Unworkable"; It Is This Court's.

The logic of the petition's reliance upon this Court's decision in *TSC Industries* (see Pet. 9 n. 13) is self defeating. Patent Rule 56 [17] was in fact modelled on the holding of *TSC Industries*: [18]

> . . . [I]nformation is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent.[19]

Thus, the standard this Court set in the securities law area (quoted *supra*, p. 7) is equivalent to that of the Patent and Trademark Office.

Patent Rule 56 has the force of law,[20] and it governs all proceedings in patent prosecution. It is at once based upon this Court's standard and consistent with the current standard applied in the district and circuit courts. It should not be modified, and it need not be reviewed.

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17. 37 C. F. R. § 1.56(a) (1980).

18. See 42 Fed. Reg. 5589-90 (1977).

19. 37 C. F. R. § 1.56(a) (1980).

20. See *Digital Equip.*, *supra* at 708.

CONCLUSION.

The petition for a writ of certiorari should be denied.

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Dated: October 31, 1981.

Petitioner's Reply Brief

Office - Supreme Court, U.S.
FILED
NOV 4 1981
ALEXANDER L. STEVAS,
CLERK

No. 81-689

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v.

KEWANEE INDUSTRIES, INC., *Respondent*

REPLY BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI

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IN THE

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OCTOBER TERM, 1981

No. 81-689

GREFCO, INC., *Petitioner*

v.

KEWANEE INDUSTRIES, INC., *Respondent*

REPLY BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI

ARGUMENT

I. The Conflict Among The Circuits Is Indisputable

Kewanee grounds its opposition on the assertion that "[t]here is no current conflict, and no case says there is one" (Opp. 4).[1] This assertion is simply not true: in *Plastic Container Corp.* v. *Continental Plastics of Oklahoma, Inc.*, 607 F.2d 885, 899 (10th Cir. 1979), *cert. denied*, 444 U.S. 1018 (1980), the Tenth Circuit flatly stated that:

> In determining materiality, the courts are not in agreement on the test to be applied. Three different tests have been used.

In sorting out this conflict,[2] the Tenth Circuit specifically rejected the Third Circuit's "might have" standard as too

[1] Significantly, Kewanee does not dispute that the proper test of materiality is an important question of federal patent law.

[2] The conflict among the circuits described in *Plastic Container* puts to rest Kewanee's suggestion (Opp. 8) that Rule 56 of the Patent Office Rules of Practice, 37 C.F.R. §1.56 (1980), originally adopted in 1977, is in conformity with a uniform standard applied by the courts. The relationship between Rule 56 and TSC Industries, Inc. v. Northway, Inc., 426 U.S. 438 (1976), is treated in the Petition at 9 n.13, and need not be repeated here.

speculative.[3] Kewanee would have this Court believe that the law is settled and that no conflict in the circuits exists. Grefco is confident that the Court will not be misled.

II. The Third Circuit Has Not Abandoned The "Might Have" Test

Kewanee admits that "[a] decade ago, the standard was liberalized, and fraud was found if the patent examiner 'might have' rejected the application absent the misrepresentation," citing to *Trio Process Corp.* v. *L. Goldstein's Sons, Inc.*, 461 F.2d 66, 73 (3d Cir.), *cert. denied*, 409 U.S. 997 (1972) (Opp. 4). Later, according to Kewanee, the Third Circuit moved to the more stringent subjective "but for" test in *In re Multidistrict Litigation Involving Frost Patent*, 540 F.2d 601, 604 n.9 (3d Cir. 1976) (Opp. 4).[4] Contrary to this assertion, however, *Frost* specifically has been recognized to apply a different standard than subjective "but for."[5]

Frost articulated the "might have" test by stating that "[a]n omission or misrepresentation is material if it makes it 'impossible for the Patent Office fairly to assess [the patent] application against the prevailing statutory criteria.' "[6] The genesis of this precise language was *Monsanto Corp.* v. *Rohm & Haas Co.*, 456 F.2d 592, 600 (3d Cir.), *cert. denied*, 407 U.S.

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[3] *Plastic Container*, 607 F.2d at 900.

[4] At no point in its opposition does Kewanee attempt to defend the "might have" test of materiality. Indeed, Kewanee has gone to great lengths to paint the Third Circuit as a subjective "but for" circuit. Kewanee's position is strong evidence of the need for this Court to definitively reject "might have" materiality.

[5] Digital Equipment Corp. v. Diamond, 653 F.2d 701, 716 (1st Cir. 1981). See also *Plastic Container*, 607 F.2d at 899 n.29, where the Tenth Circuit specifically recognized the Third Circuit's standard as "might have." Both of these circuits also would disagree with Kewanee's characterization (Opp. 4 n.8) of the Second Circuit as a "but for" circuit.

[6] *Frost* 540 F.2d at 604 n.9.

934 (1972), decided prior to *Trio Process* in 1972 at a time when even Kewanee admits the Third Circuit was applying a "might have" test of materiality (Opp. 4 n.7). The Third Circuit in *Frost* cited with approval and adopted the *Frost* district court definition of materiality [7] which equated the "might have" language of *Trio Process* with the "impossible for the Patent Office fairly to assess" language of *Monsanto*. Moreover, in referring to the "impossible for the Patent Office fairly to assess" language, the *Frost* district court observed that recent opinions of district courts in the Third Circuit have "accept[ed] *this* 'but it might have' test" (emphasis added). [8]

Thus, Kewanee's historical development is fiction. The Third Circuit applied the "might have" test in 1972 in *Monsanto* and *Trio Process;* it applied the "might have" test in 1976 in *Frost;* and it applies the "might have" test today. [9]

III. The Application Of The "Might Have" Test By The Courts Below Is Central To The Erroneous Holding Of Fraud

The trial court unabashedly applied the "might have" test, [10] and Kewanee's argument that even under the subjective "but

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[7] 540 F.2d at 604 n.9, citing In re Multidistrict Litigation Involving Frost Patent, 398 F. Supp. 1353, 1368-69 (D. Del. 1975). Contrary to Kewanee's contentions, there has been no "shocking misquote" or mischaracterization of the Third Circuit materiality standard in the Petition.

[8] In re Multidistrict Litigation Involving Frost Patent, 398 F. Supp. at 1369 n.30. As discussed at Pet. 13-14 this "impossible . . . to assess" analysis is the essence of a "might have" test because contrary to this Court's holding in *TSC Industries*, it stops short of requiring any finding of what the Patent Office would have or should have done.

[9] In Hercules, Inc. v. Exxon Corp., 497 F. Supp. 661, 689 (D. Del. 1980), the district court, applying the current law of the Third Circuit, states that "[a] misrepresentation is material when its existence might have influenced a patent examiner" (footnote omitted). See also the decision below at A-49, quoted at Pet. 12 n.17.

[10] Notwithstanding Kewanee's assertion to the contrary (Opp. 6), A-49-50 typifies the trial court's application of the "might have" test to the JCP

for" standard the courts below would have found fraud is without merit.[11] Had the subjective "but for" test urged by Kewanee been applied by the courts below, the analysis of the elements of fraud would have been totally different, and fraud would not have been found.

CONCLUSION

For the reasons presented herein, a writ of certiorari should issue to review the judgment order of the Third Circuit.

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article, as well as to the test results. Specifically, the trial court stated that "had the Examiner been advised that '*one inch* of fiber board or other barrier' qualified on industry construction tests [as disclosed in the JCP article] . . . he *might* seriously have questioned whether the Bolster patent should be granted" [A-49, emphasis added except for first occurrence].

[11] See Pet. 13-15. Kewanee's attempt to correct the facts as set out in Grefco's Statement of the Case is as flawed as its legal analysis. Kewanee's statement that Grefco "does not question the district court's conclusion that the fraud was 'an affirmative intent to deceive or at least a gross negligence or recklessness in misrepresenting the truth,' " (Opp. 2) is incorrect. *Id.* The improper materiality standard applied by the courts below so tainted their perception of the facts as to fatally infect the holding with respect to intent. This Court's reversal of the standard applied in determining materiality will lead to a resolution of all subsidiary aspects of the fraud decision.

[12] See Pet. n.2 for Grefco's corporate affiliation.

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